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Handbook
Maintenance Instructions
NAVY MODEL
FJ-4B
AIRCRAFT

SECTION VII
ARMAMENT
AND
RELATED SYSTEMS

PUBLISHED BY DIRECTION OF
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Introduction to SECTION VII

THIS HANDBOOK IS ONE OF A SERIES OF TEN which contain instructions required by using activities for the maintenance of Model FJ-4B aircraft. These are systems type handbooks. Each system in the aircraft is covered completely in a particular handbook. This includes all hydraulic, pneumatic, mechanical and electrical portions of the system. This has been done in order to assist the mechanic in becoming familiar with and in maintaining all phases of each system.

The "Armament and Related Systems" handbook contains only non-classified information on armament equipment peculiar to the FJ-4B aircraft. Included is coverage for the pneumatic system. Additional information on classified armament equipment is contained in the Supplemental Handbook of Maintenance Instructions for FJ-4B Aircraft (NAVAER 01-60JKE-502A).

This handbook contains information necessary for the performance of class C and class D maintenance on those items of Contractor Furnished Equipment for which there are no separate handbooks. This handbook does not contain instructions for the overhaul of components. Such instructions are contained in separate handbooks of overhaul instructions for the individual equipment.

Instructions for the repair of aircraft structure are contained in the Handbook of Structural Repair (NAVAER 01-60JKD-503) for these aircraft.

Data necessary for obtaining replacement parts and complete identification of parts are contained in the Illustrated Parts Breakdown (NAVAER 01-60JKD-504) for these aircraft.

Weight and Balance Data are found in the applicable AN 01-1B-40 handbook for each of these aircraft.

To identify and obtain these publications and handbooks covering separate items of equipment, refer to the Naval Aeronautic Publications Numerical Index (NAVAER 00-500).

BuAer Serial Numbers 139531 through 139555, 141444 through 141489 and 143493 through 143643 have been assigned to the FJ-4B. In addition, a lower case letter has been made a part of each serial number as it is painted on the aircraft. These lower case letters have been assigned to blocks of serial numbers as follows:

SERIAL NUMBER	LETTER
139531 through 139555	i
141444 through 141489	j
143493 through 143542	k
143543 through 143593	l
143594 through 143643	m

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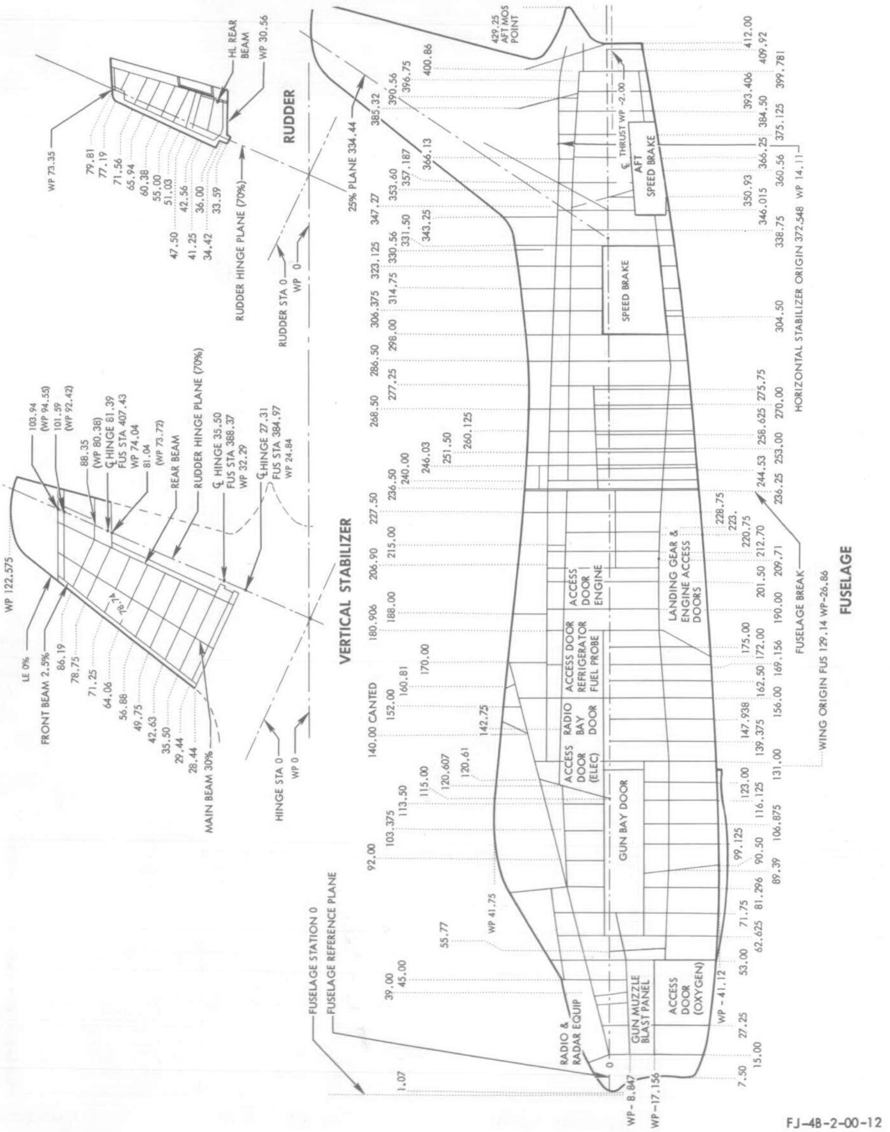
Section IX ELECTRONIC SYSTEMS

Section X WIRING DATA



FJ-4B Airplane

GENERAL INFORMATION



FJ-4B-2-00-12

Figure No. 7-1. Airplane Stations (Sheet 1)

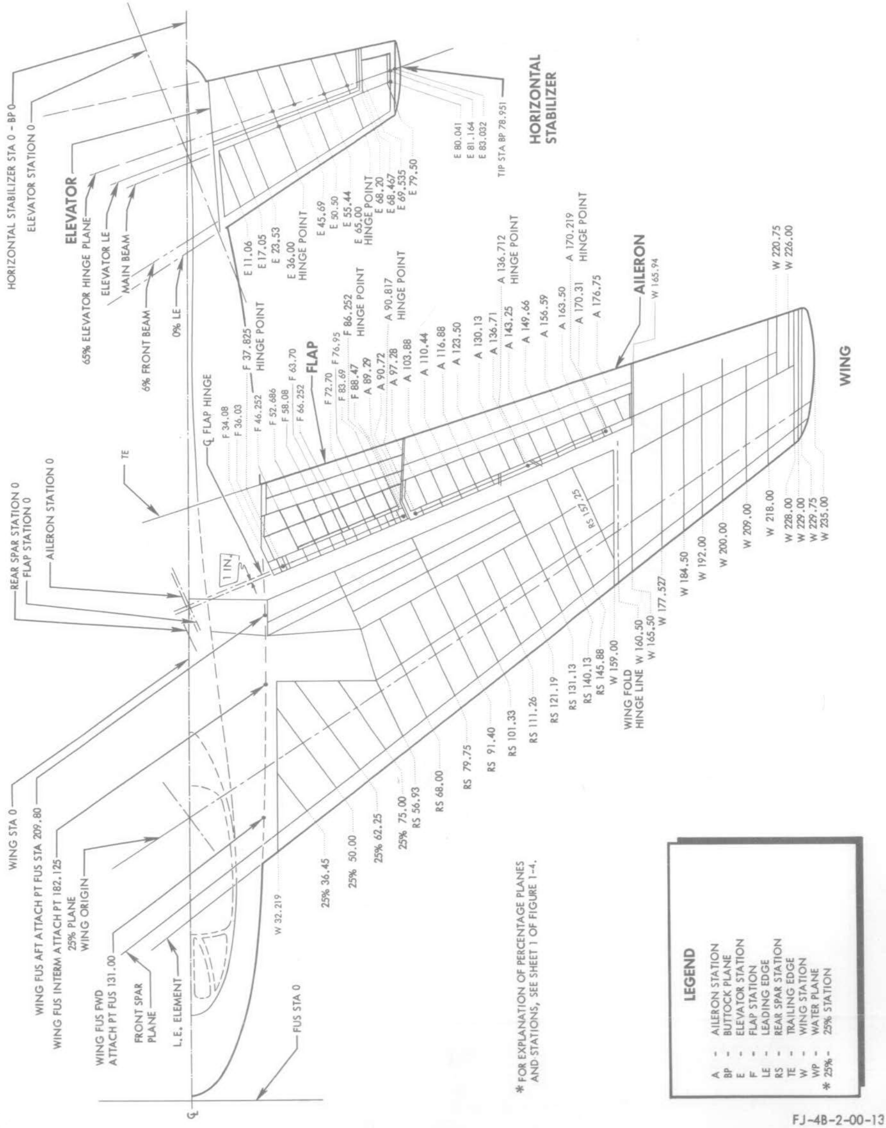


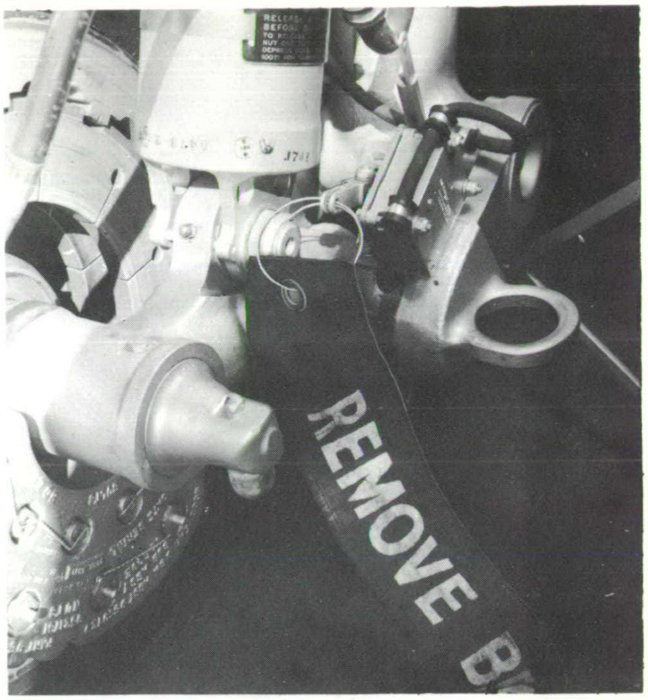
Figure No. 7-1. Airplane Stations (Sheet 2)

Warning Ground safety locks and pins are to be installed at all times, except for flight and gear retraction check. Remove immediately before flight and stow in cockpit map case.

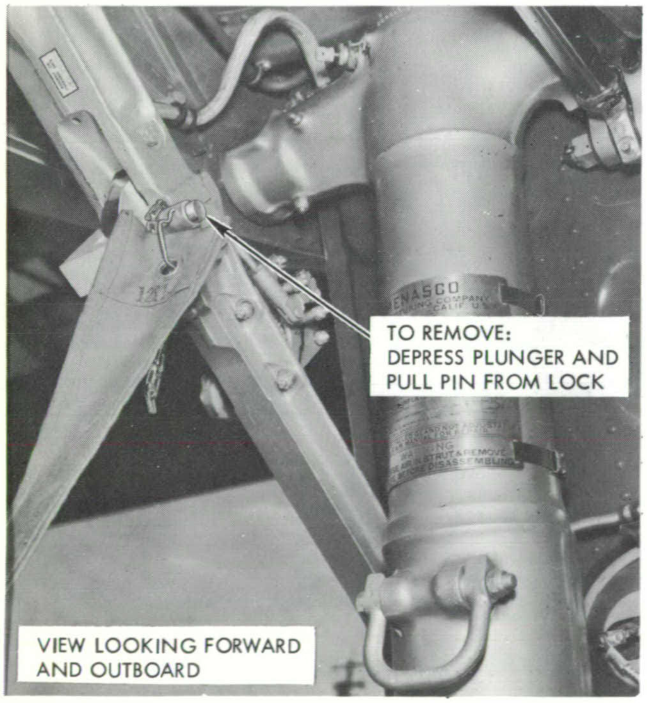
A time-saving method for performing certain testing procedures on the airplane (which normally would require the use of ground jacks) may be accomplished by disabling the ground safety switch. Attach a red warning flag, similar to the flags used on the landing gear ground safety locks, whenever the ground safety switch is disabled.

Warning When a red warning flag has been attached to the ground safety switch to indicate a disabled switch, never remove flag from the unit until switch has been properly connected.

GROUND SAFETY SWITCH



NOSE LANDING GEAR GROUND SAFETY LOCK



Note There is no ground safety lock for the arresting gear.

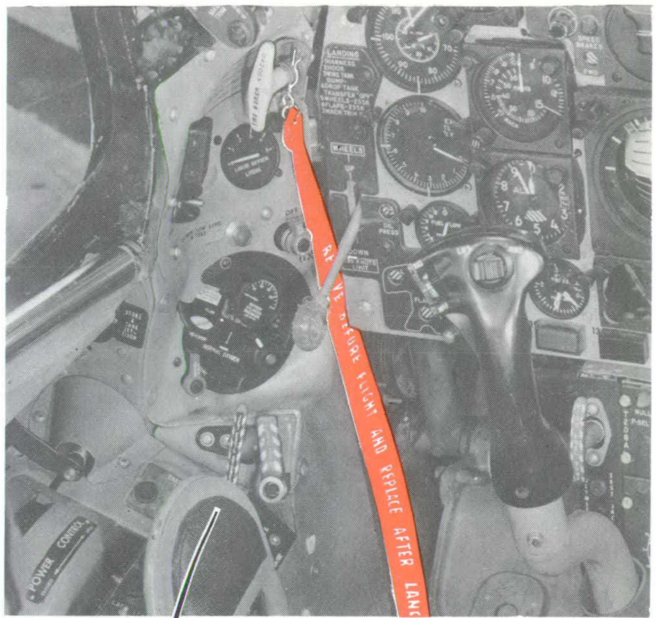
MAIN LANDING GEAR GROUND SAFETY LOCK

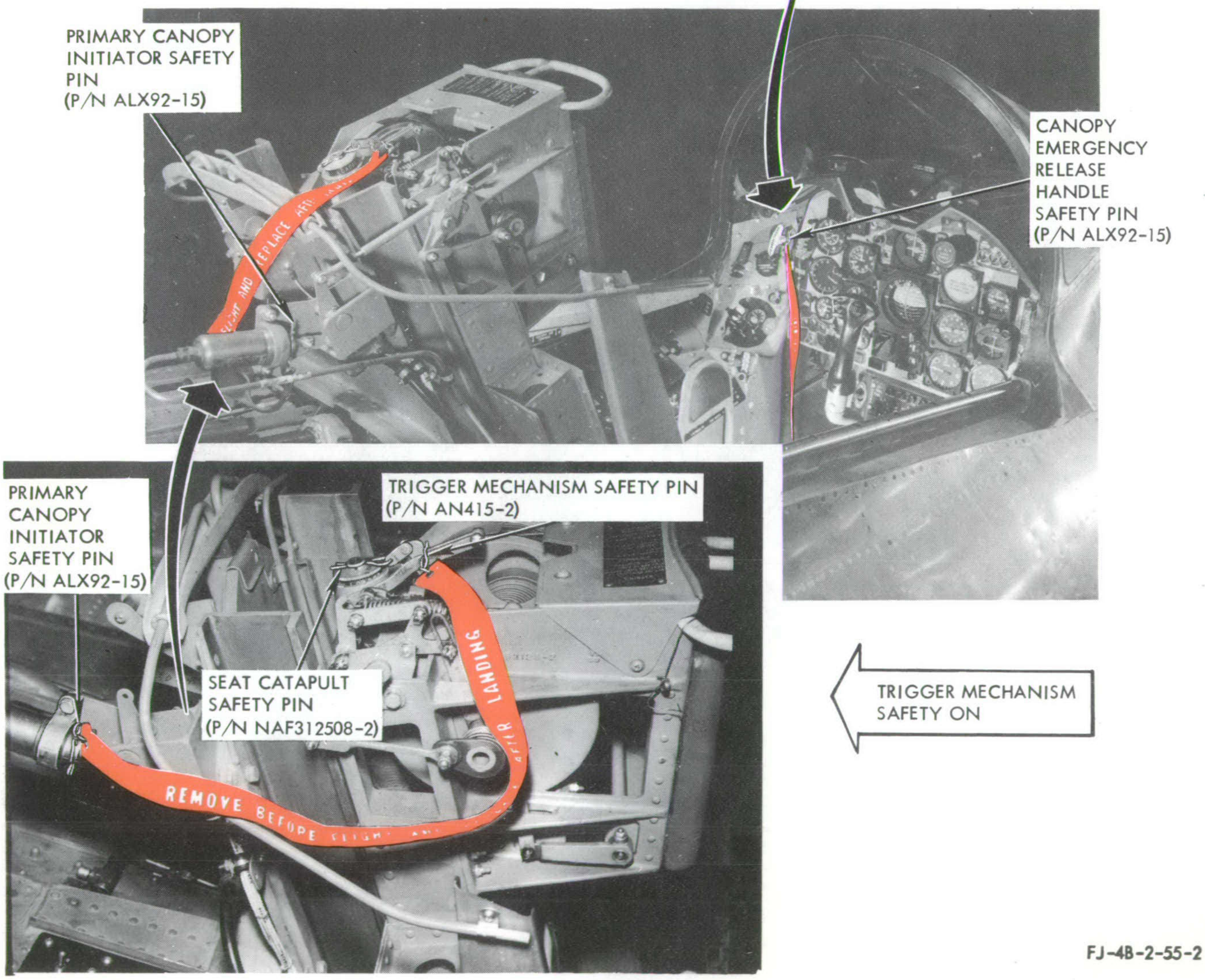


Figure No. 7-2. External Ground Safety Locks and Pins

Warning

- Keep out of the cockpit unless maintenance is required.
- Always consider the emergency escape system loaded and armed.
- Know where the safety pins are and be certain of their installation.
- Do not manipulate linkage wihout full knowledge of the emergency escape system.
- Do not use linkage or handles as handgrips.
- The catapult cartridge, canopy remover, remover initiators and exactor are ordnance items and should be checked and maintained only by qualified personnel.



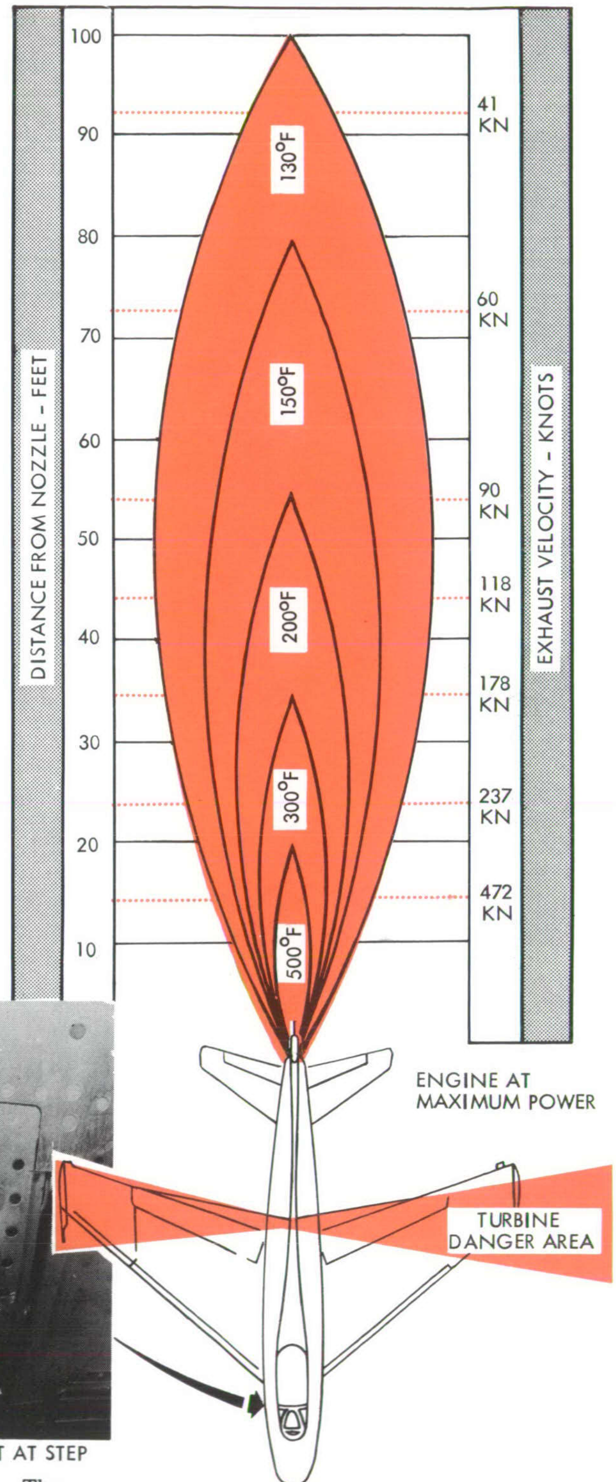


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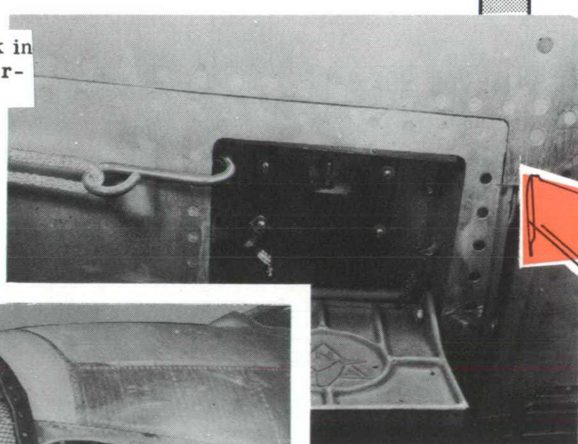
Figure No. 7-3. Emergency Escape Ground Safety Pins

Warning

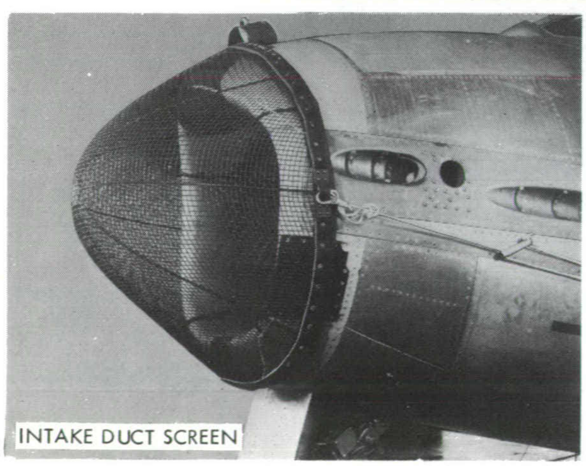
- Do not stand near the front of the air inlet duct while the engine is operating.
- Always approach the airplane from the side but not in the plane of rotation of the turbine when the engine is running.
- Avoid wearing hats or other loose clothing when working in the run-up area.
- Do not carry loose articles such as pencils, key rings or tools when near the air inlet duct.
- Do not foolishly experiment with the margin of safety by standing near, or feeling with your hand, the suction created by the engine.
- Do not stand on wing of the airplane while engine is operating, unless assistance is required during cockpit check-out or functional check of equipment.
- The loudest sustained noise produced by man is the noise of a jet engine operating at high rpm. Jet-engine noise is dangerous to personnel working in the immediate area. At distances from 50 to 200 feet, wear ear plugs and at distances within a radius of 50 feet, wear ear plugs and a type of over-the-ear protector. Prolonged exposure to jet-engine noise can cause pain and damage to the inner ear. Other effects of prolonged exposure are fatigue, nervousness and impairment of hearing.
- Do not stand at the edge of the blast area as the temperature could suddenly increase with engine speeds.



Place retaining rope hook in existing hole located in forward frame of step.



ATTACH POINT AT STEP

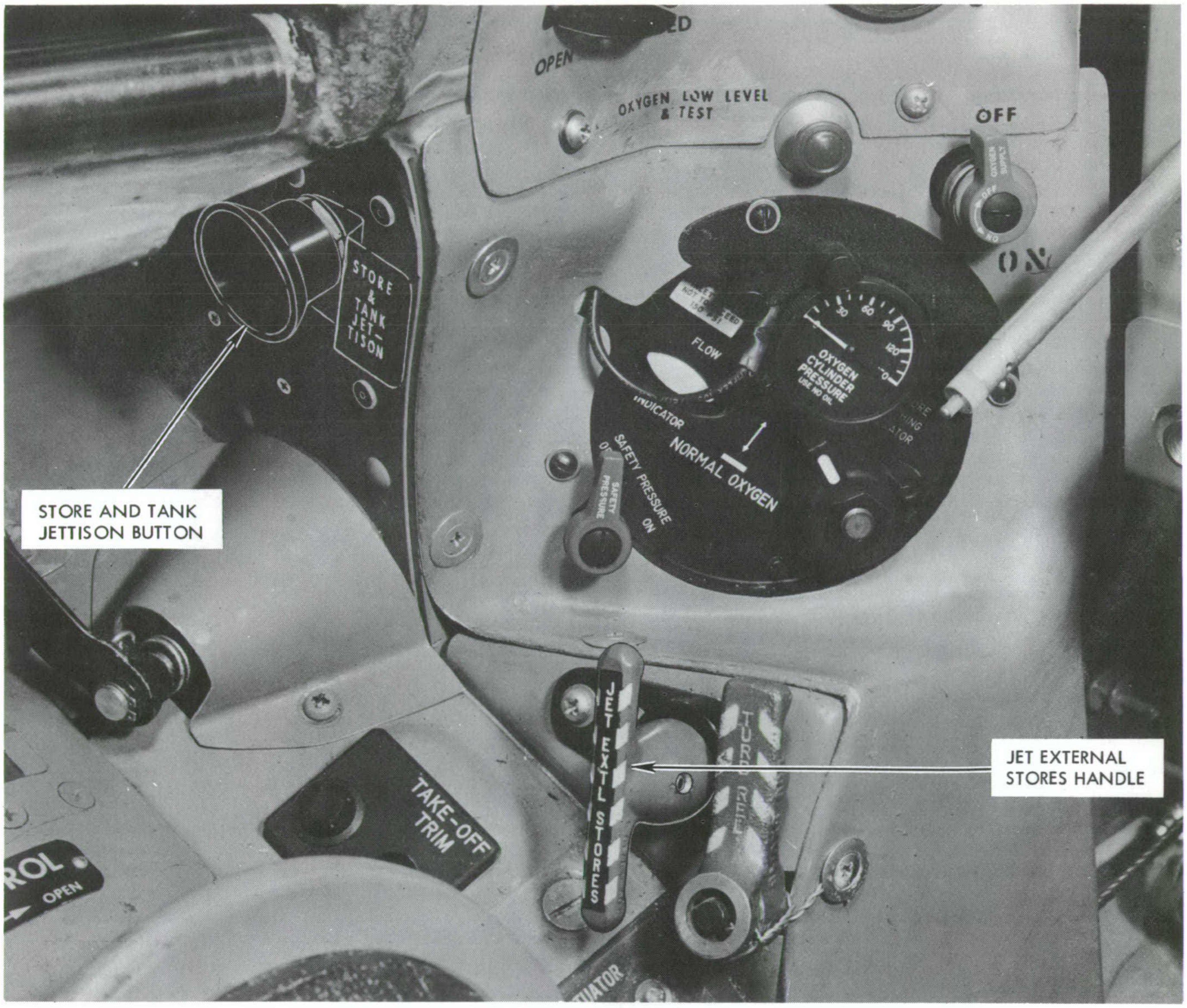


Caution The area in front of the air inlet duct should be swept clean to minimize the possibility of dirt or other objects being drawn into the compressor and damaging the engine.



FJ-4B-2-55-3

Figure No. 7-4. Ground Run-up Danger Areas



Note

- Pulling the JET EXTL STORES handle will jettison all stores any time the aircraft battery or external power source is connected and EXTL STORES EMGENCY RELEASE circuit breaker is in. (Power is from the battery bus.)

- Depressing the STORE & TANK JETTISON button will jettison all stores only when the weight of the airplane is not on the main landing gear and STORE JETTISON and DROP TANK circuit breaker is in. (Power is from the primary bus.)

- Depressing the PILOT'S CONTROL STICK button will jettison all stores only when the landing gear handle is in the "UP" position, aircraft wieght is off the main gear, the ARM MASTER switch is in the "ON" position, BOMB and GUN TRIGGER circuit breaker in, and station selector is set on SALVO. (Power is from the armament bus.)

FJ-4B-2-63-71A

Figure No. 7-5. External Stores Jettisoning

TEST POINT TROUBLE SHOOTING.

To ease and expedite electrical maintenance, test point trouble shooting data has been incorporated in system trouble isolation procedures and system wiring diagrams. As any system failure or malfunction may result from any one or a combination of electrical, hydraulic, pneumatic or mechanical reasons, all probable causes (reasons) for a stated trouble are covered in the same trouble isolation chart. There are three types of test points: major, secondary and minor. Textual references to these test points are made within each system trouble shooting paragraph and the specific location of each test point may be determined by referring to the appropriate system wiring diagram in Section X. No test point designation will be duplicated nor will more than one test point designation be given to any test point.

MAJOR TEST POINTS.

Major test points are used to isolate a power system failure to a physical portion of the airplane or to a group of systems. Major test points are symbolized on system wiring diagrams by a star encircled Arabic numeral. Major test points are referred to in text as: test point 1, test point 2, etc. Some examples of major test points are: generator and inverter outputs, power distribution connections, etc.

SECONDARY TEST POINTS.

Secondary test points are used to isolate failure to a specific system or to a specific item within a system. Secondary test points are symbolized on system wiring diagrams by an encircled capital letter(s). The letters "I" and "O" are not used to avoid confusion with the numerals one and zero. Secondary test points are referred to in text as: test point A, test point AB, etc. Some examples of secondary test points are: power inputs to individual units, tie-ins with parallel or interrelated systems, sequence switches, etc. Secondary test points for any specific system will always have as their initial identifying letter the same letter as the initial letter of the wire numbers of that system.

MINOR TEST POINTS.

Minor test points are used to isolate failure within a unit. Minor test points are symbolized on system wiring diagrams by an encircled capital letter and Arabic numeral. The letters "I" and "O" are not used to avoid confusion with the numerals one and zero. Minor test points are referred to in text as: test point A1, test point A2, etc. Some examples of minor test points are: continuity through a switch or a relay that is part of a unit, resistance readings of items within a unit, etc. Minor test points for any specific system will always have as their initial identifying letter the same letter as the initial letter of the wire numbers of that system.

USE OF TROUBLE SHOOTING CHARTS.

The best trouble shooting aid is preventive maintenance and cleanliness. The next best trouble shooting aid is thorough knowledge of the theory and operation of the system in question. A thorough knowledge of the system permits rapid determination of the most likely probable cause for any given trouble and thereby reduces trouble shooting time and effort. The third most important aid is safety; observe all safety rules, check to make sure that the airplane and any attached ground power equipment is properly grounded, check to make sure that all ground safeties are installed, follow the trouble shooting instructions and if it is a two-man job, get another man to help. What is the trouble? Check the squawks, observe or perform an operational or functional check of the system in question. Check the trouble shooting charts of the system for the determined trouble. Select the most probable cause(s) and proceed to isolate the trouble; set up the system as specified in the "System Conditions" portion of the chart. Use the appropriate meters. Do not make ohmmeter tests or continuity checks on an electrically "hot" airplane. Complete check-out of the system in question without correction of the trouble may indicate that a parallel or interrelated system is at fault. If so, refer to that system for appropriate trouble shooting information. When a remedy is performed that does not correct the trouble, select the next most probable cause and continue trouble shooting. Isolation procedures are set up to require a minimum of effort. Each procedure should either isolate the trouble itself or isolate the portion of the circuit that contains the trouble. When a test point procedure is called out for an item (for example, a valve solenoid), parts of that procedure not spelled out which may lead to isolating the fault are: visual inspection for signs of physical damage, check of the ground connection or bonding and a check for good electrical connections. Similarly, when test points are called out for relay terminals, the switch section of the relay involved should be checked for proper action and continuity. The various portions of the trouble shooting charts and their functions are as follows:

a. TEST EQUIPMENT. This portion of the charts contains a list of all test equipment that will be required to perform any isolation procedure that follows on the same chart.

b. SYSTEM CONDITIONS. This portion of the chart specifies the desired system conditions for the tests that will follow. Some isolation procedures may require a change to these conditions; if so, the new conditions will be given in note form.

c. TROUBLE. This is the observed symptom, malfunction, or fault.

d. PROBABLE CAUSE. The probable cause(s) states the condition or reason causing the trouble. Probable causes are listed in their most likely order. The probable causes may be electrical, mechanical, hydraulic, pneumatic, etc, or a combination of these reasons.

e. ISOLATION PROCEDURE. This portion of the charts is a positive statement of action. If the probable cause is nonelectrical, there will be no mention of test points; if electrical, specific directions related to one or more test points will be given. Isolation procedures are listed in their most likely or accessible order. What

meter is to be used will be determined by the required meter reading(s). Use the appropriate system wiring diagram in Section X to locate test points and to perform wire segment continuity checks. Many isolation procedures require the use of test points located at a connector. In such cases, it is necessary to disengage the connector and to apply the test probe to the plug or receptacle portion of the connector as shown on the system wiring diagram. Connectors should never be disengaged with electrical power applied to the airplane. Do not damage connector sockets by inserting test probes.

f. METER READING. If the isolation procedure is nonelectrical, this portion of the chart will indicate that none is required. If test points have been specified in the isolation procedure, the value and type of reading will be stated. Resistance and voltage readings are the type most commonly required for the isolation procedures; values given will indicate their type and the corresponding type of meter should be used to obtain the reading.

g. REMEDY. For nonelectrical isolation procedures, the remedy will indicate the maintenance action required depending upon the results of the isolation procedure. For electrical isolation procedures, the remedy will indicate the maintenance action required for the meter reading obtained. Most remedies will indicate a definite maintenance action, but some remedies will indicate that further isolation procedures should be performed. Some meter readings will indicate that the airplane wiring is at fault (open or shorted) and the remedy will be to perform a wire segment continuity check. Such continuity checks should be performed so as to minimize effort. Remove power and disconnect wires as necessary; then, check for continuity at the most accessible mid-point of the circuit; in this manner, several wire segments can be checked for continuity at one time.

WARNING

Never disconnect wires or disengage disconnects with electrical power applied to the airplane. Always ground the airplane and any attached ground power equipment.

Note

Secondary test points are listed alphabetically and opposite to each applicable wiring diagram title. Figure numbers of the wiring diagrams listed can be found in the Wiring Diagram Index of Section X of this handbook. Major test points, not listed, can be found in the Starting and D-C Generating System, the D-C Power Distribution System and the A-C Power Supply and Distribution System wiring diagrams. Minor test points, also not listed, can be found by associating them with similar secondary test points.

TEST POINT	WIRING DIAGRAM TITLE
A, AA-AZ and AAA-AAZ	Gun Firing System
ABA-ABZ	Ammo Booster System
ACA-ACZ	Gun Pneumatic Compressor Control System (Gun charging)
ADA-ADZ	Aircraft Fire Control System, Mark 16 Mod 1
AFA-AFZ	Gun Firing System
AGA-AGZ	Gun Firing System (Gun bay purging)
APA-APZ	Gun Pneumatic Compressor Control System
ARA-ARZ	Bomb and Rocket System Permanent Provisions (Bombing system)
ASA-ASZ	Bomb and Rocket System Permanent Provisions (Rocket system)
AXA-AXZ	Armament Packages
AZA-AZZ	Bomb and Rocket System Permanent Provisions (Bombing system)
BA-BZ	Gun Camera System
G, GA-GZ and GAA-GAZ	Landing Gear Sequencing System
GDA-GDZ	Wing Fold System
PCA-PCZ	D-C Power Distribution System (Right-hand rear vertical console)
PHA-PHZ	D-C Power Distribution System (Cover assembly for right-hand radio bay electrical junction box)
PJA-PJZ	D-C Power Distribution System (Top deck circuit-breaker panel)
XA, XAA-XAZ	A-C Power Supply and Distribution System (Phase "A" circuits)
XC, XCA-XCZ	A-C Power Supply and Distribution System (Phase "C" circuits)

CONSUMABLE MATERIALS

ITEM NO.	NOMENCLATURE	SPECIFICATION OR STOCK NO.	MANUFACTURER	SUBSTITUTE
19	Cleaner, Rifle Bore	JAN-C-372; Stock No. G6850-224-6663		
60	Graphite, Lubricating (Dry Powder)	MIL-G-6711		
79	Lubricating Grease	NRL-GLT-700-60; Stock No. J941-L-4025		
82	Lubricating Grease (General Purpose Aircraft)	MIL-L-7711; Stock No. WF9150-157-5361 **CAUTION** ● The special synthetic oils used in this grease may soften paint, natural rubber, neoprene and electrical insulating materials. ● This grease should not be used on equipment requiring extreme pressure or special anti-wear additives.		
85	Lubricating Grease, Pneumatic System	MIL-L-4343		
86	Lubricating Oil, Aircraft Instrument, Low Volatility	MIL-L-6085; Stock No. WF9150-231-6686		
88	Lubricating Oil, General Purpose, Low Temperature	MIL-L-7870; Stock No. WQ9150-263-3490		
115	Soap, Castile	MIL-S-4282		
119	Solvent, Dry Cleaning (Stoddard Solvent)	P-S-661, Type 1; Stock No. W6850-264-9039		

ARMAMENT SYSTEMS

7-1. ARMAMENT SYSTEMS.

7-2. The armament complement of the airplane consists of four Mark 12 Mod 3 20mm automatic aircraft guns and their related components, the gun camera system, the armament control system and an external stores system. The Mark 12 Mod 3 20mm guns are equipped with mechanical recoil-operated Mark 9 Mod 4 and Mod 5 feeders, pneumatic chargers and pneumatic buffers. The camera system consists of an AN-N6A sight reticle camera mounted on the gun sight mount. The camera simultaneously photographs the sight reticle image and the target, recording the results of aerial gunnery. The armament control system consists of the radar set, AN/APG-30A, and the aircraft fire control system. The Mark 8 Mod 8 sight unit and related components make up the aircraft fire control system. The armament control system automatically computes leads and produces a visual sighting image for use as a reference during target tracking. The airplane can be equipped to carry external stores by the installation of various external store packages. The external store packages contain the necessary pylons, bomb and rocket racks and relay and control panels to equip the airplane to carry bombs, rockets or missiles. External stores are carried at six underwing stations, three under each wing. A Mark 12, a Mark 7 or a Mark 28 store may be carried at the left-hand intermediate station. The airplane can be equipped to tow and release aerial gunnery tow targets by the installation of a tow-target package. Provisions for the installation of the tow-target package are incorporated in the design of the airplane. The airplane armament components may be harmonized independently or together.

GUNNERY SYSTEM

7-3. GUNNERY SYSTEM.

7-4. The gunnery system of the airplane (figure 7-6) consists of four Mark 12 Mod 3 20mm automatic aircraft guns and their related components. These fixed, forward firing guns are mounted in pairs in each side of the nose section, below and forward of the cockpit. The guns are supported by trunnion yoke mounts at the forward end of the receiver and by adjustable trunnion mounts at the aft end of the receiver. Each gun is equipped with a Mark 9 mechanical feeder and a muzzle stabilizer. Ammunition boost motors are provided for each gun. An armament control system, an AN-N6A gun camera and provisions for carrying ammunition complete the gunnery system. Each of the four ammunition containers can carry 114 rounds of 20mm ammunition. Expended ammunition links and cases are retained in containers provided in the gun bays. Hydraulically operated purge entrance and exit doors in the forward and aft ends, respectively, of each gun bay provide gun bay purging during gun firing.

7-5. FUNCTION OF GUNNERY SYSTEM.

7-6. When the airplane is on the ground with the landing gear handle in the "DOWN" position, the electrical circuit to the armament master relay is interrupted, de-energizing the relay and removing electrical power from the armament bus. When the landing gear handle is placed in the "UP" position, the armament master relay can be energized, permitting electrical power to reach the armament bus. (See figure 7-6.)

WARNING

> Do not move the landing gear handle to "UP" position or leave the landing gear and wing fold circuit breaker out unless necessary. Moving the landing gear handle to the "UP" position or leaving the landing gear and wing fold circuit breaker out makes it possible to energize the armament bus by positioning the ARM MASTER switch to "ON." Placing the landing gear handle in the "UP" position or leaving the landing gear and wing fold circuit breaker out can result in inadvertent firing of the guns and/or other armament installations.

Positioning the ARM MASTER switch to "ON" and momentarily actuating the ground firing control switch (GROUND FIRING CONTROL) will energize the armament bus for ground operation of the armament systems.

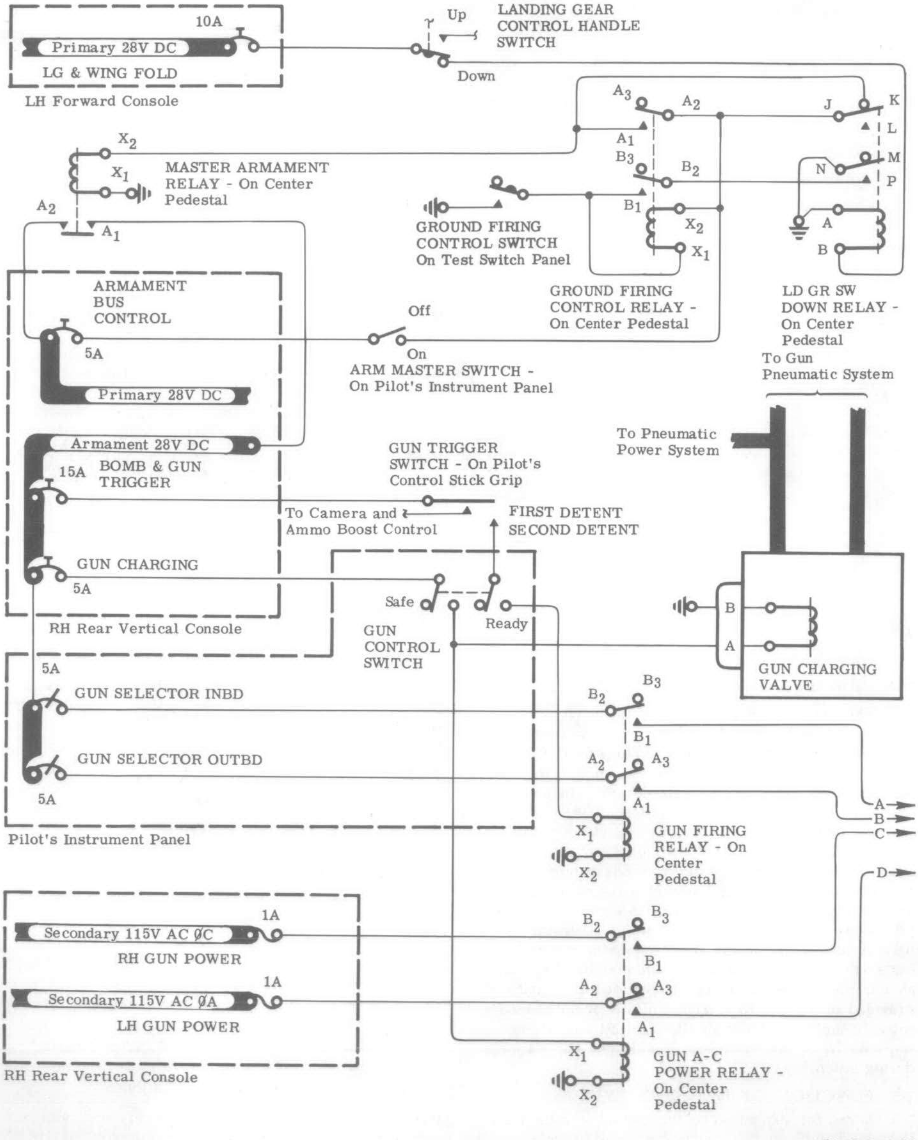


Figure No. 7-6. Gunnery System (Sheet 1)

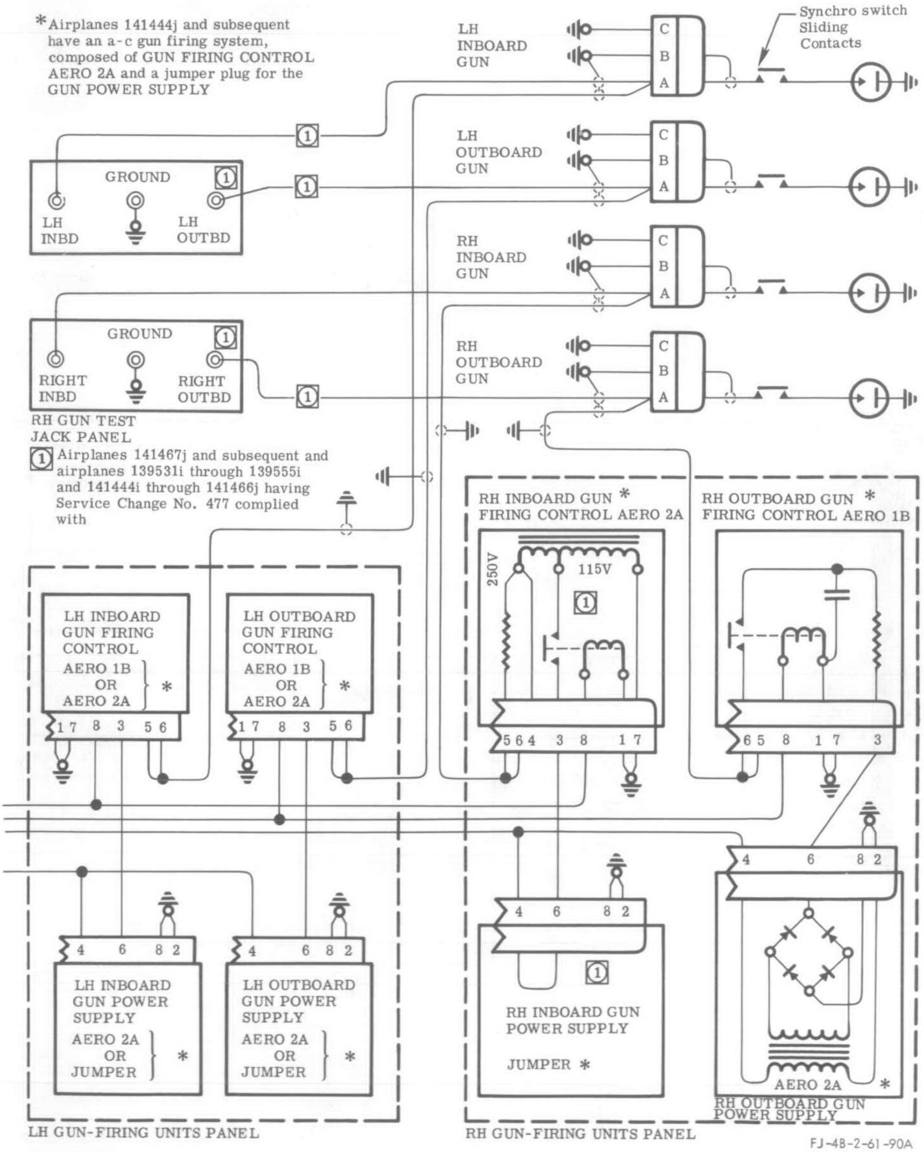


Figure No. 7-6. Gunnery System (Sheet 2)

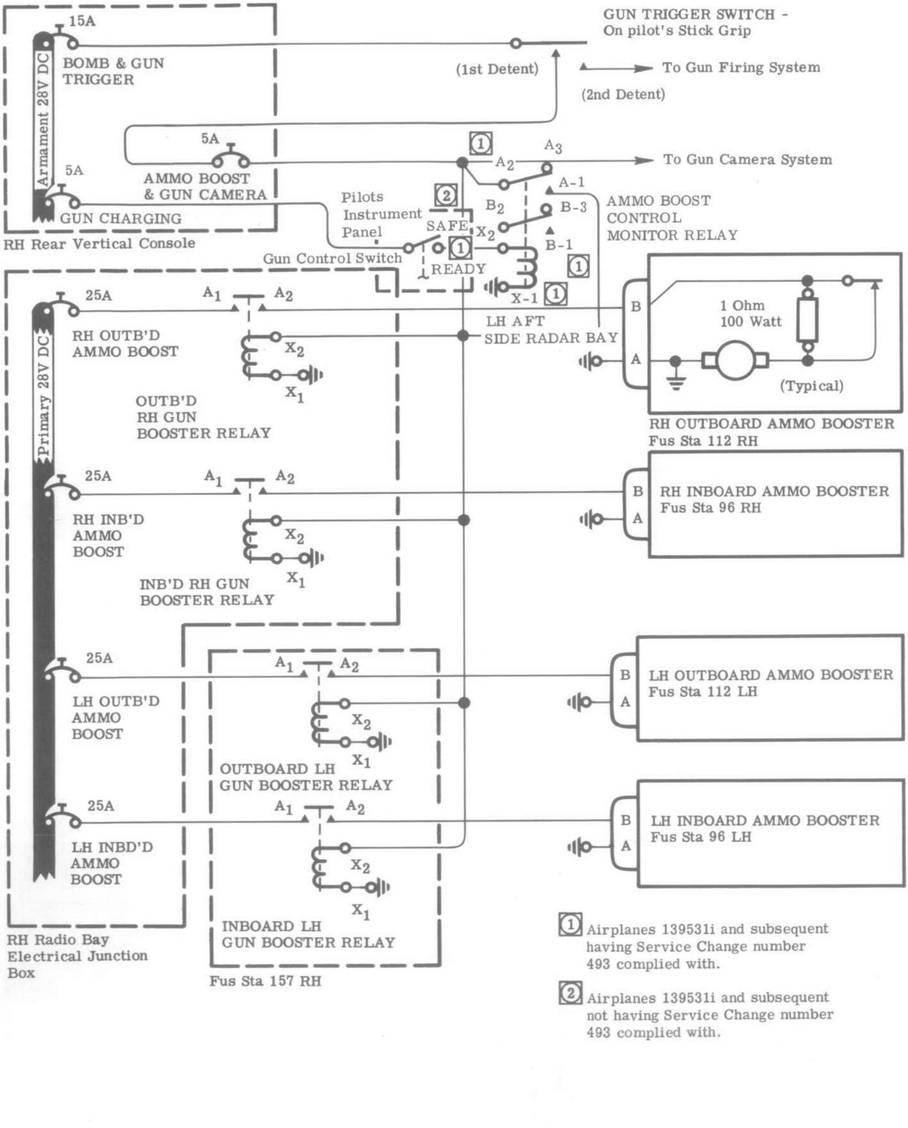


Figure No. 7-7. Ammunition Boost Motor System

WARNING

Do not raise landing gear handle to the "UP" position to route electrical power to the armament bus for ground armament operation. Always use ground firing control switch to energize the armament bus for ground operations.

To initiate gun firing with the landing gear retracted, position the ARM MASTER switch to "ON," directing 28-volt d-c power to the armament bus. Position the GUN SELECTOR switches to "INBD" and/or "OUTBD," routing electrical power to the gun firing relay. Place the GUN CONTROL switch in the "READY" position to energize and close the normally open pneumatic charging valves.

Note

If Service Change No. 493 has been complied with, the gun control switch furnishes power from the armament bus to energize the ammo booster motor monitor control relay. The GUN CONTROL switch must be in the "READY" position for power to be available to the ammo boost circuit (figure 7-7). With these new circuit conditions, the camera may be operated without operating the ammo boost motors by placing the GUN CONTROL switch in the "READY" position.

When the charging valves are closed by the application of electrical power, the breechblock, which has been retracted, picks up a round as it is rammed into battery. Simultaneously with the energizing of the normally open charging valves, electrical power is supplied to the gun's a-c power relay, energizing the relay coil. The a-c power relay supplies 115-volt a-c power to the Aero 2A gun firing controls, which supply 250-volt a-c power to the guns. When the gun trigger switch is depressed to the second detent, 28-volt d-c power is routed to the Aero 2A gun firing control relays, allowing a-c power to pass through the jumper plugs and gun firing controls to the gun firing pins and ammunition primer. During gun firing, the gun bolt, operated by gun gas pressure, automatically extracts each expended case and positions a new round in the chamber. The guns will continue automatically to fire and reload as long as the trigger is depressed fully and ammunition is available. If one or more guns fail to fire due to a stoppage, all guns are recharged when the GUN CONTROL switch is moved momentarily to the "SAFE" position and then returned to "READY." The procedure of moving the GUN CONTROL switch to "SAFE" and returning it to "READY" changes the position of the normally open charging valves from closed to open and back to closed. When the GUN CONTROL switch is moved to "SAFE," the charging valves open to port air pressure to the gun chargers which cycle the guns and extract a round from each gun. When the charging valves are energized (closed) by moving the GUN CONTROL switch to "READY," the chargers drive the bolts into battery and position new rounds in the chambers. The mechanical recoil-actuated feeders and the ammunition booster motors apply a constant force to the belted ammunition to feed a new round when required. When the ARM MASTER switch is positioned to "OFF" or the landing gear is extended, electrical power is removed from the armament bus. At the same time, the pneumatic gun-charging valves are de-energized to retract the gun bolts, extract the round from the chamber and hold the bolt in the retracted position.

7-7. TROUBLE SHOOTING GUNNERY SYSTEM.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: 28-volt d-c external power applied to airplane.
Landing gear handle in "DOWN" position.
ARM MASTER switch to "ON" position.
GROUND FIRING CONTROL switch momentarily depressed.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL ARMAMENT BUS POWERED SYSTEMS INOPERATIVE.			
No power to armament bus.	Check between test points PFA and PCF and ground.	28 volts dc.	Refer to individual system trouble shooting charts.
		Zero volts.	Continue trouble shooting.
	Check primary bus voltage at center pedestal voltmeter test jacks.	28 volts dc.	Refer to probable cause, "Defective MASTER ARMAMENT Relay."
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL ARMAMENT BUS POWERED SYSTEMS INOPERATIVE. (Cont)			
Defective MASTER ARMAMENT relay.	Check test points AFC and AU to ground.	28 volts dc at test point AFC and zero volts at test point AU.	Replace defective MASTER ARMAMENT relay.
		Zero volts at both test points AFC and AU.	Refer to probable cause, "Defective MASTER ARMAMENT Relay Control Circuit."
Defective MASTER ARMAMENT relay control circuit.	Check test point AFB to ground.	28 volts dc.	Continue trouble shooting.
		Other than 28 volts dc.	Perform wire segment continuity check between test points AFB and 10 and replace defective switch, wire segment or circuit breaker.
	Note External power removed for this check. Check between test points AFB and AFC.	Zero ohms.	Replace defective GROUND FIRING CONTROL relay or associated wiring as necessary.
		Other than zero ohms.	Replace defective LD GR SW DOWN relay or associated wiring.

SYSTEM CONDITIONS: 28-volt d-c external power applied to airplane.
Airplane on jacks.
Landing gear handle in "UP" position.
ARM MASTER switch to "OFF" position.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL ARMAMENT BUS POWERED SYSTEMS INOPERATIVE IN FLIGHT BUT GROUND CHECK SATISFACTORY.			
Defective landing gear switch down (LD GR SW DOWN) relay or control circuit.	Check test point AFB to ground.	Other than approximately 80 ohms.	Continue trouble shooting.
	Check test point AFB to ground.	Zero volts.	Replace defective LD GR SW DOWN relay or associated wiring.
		28 volts dc.	Replace defective landing gear control switch.

TEST EQUIPMENT: A-C voltmeter.
D-C voltmeter.
Gun circuit tester probe.

SYSTEM CONDITIONS: 28-volt d-c external power applied to airplane.
Armament bus energized.
GUN SELECTOR switches to "INBD" and "OUTBD" positions.
GUN CONTROL switch to "READY" position.
BOMB & GUN TRIGGER, GUN CHARGING, ARMAMENT BUS and LG & WING FOLD circuit breakers engaged.
GUN BAY PURGE and AMMO BOOST & GUN CAMERA circuit breakers disengaged.
Gun trigger switch depressed and maintained at second detent.

WARNING

Make certain that guns are made safe by removing all ammunition.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ONE OR MORE GUNS FAIL TO FIRE.			
Defective gun internal circuit.	Refer to paragraph 7-36.		Replace defective gun as required.
Defective gun firing control units, Aero 2A (a-c) or Aero 1B (d-c).	Check between test points AFE, AFF, AFG and AFH and ground as required.	250 volts ac or 300 volts dc, depending on whether a-c or d-c gun firing control units are used.	Replace defective wiring at gun disconnect or replace defective disconnect.
		Zero volts.	Continue trouble shooting.
	Check between test points AFJ, AFK, AFL and AFM and ground as required. **Note** Use test points AU, AV, AW and AX for airplanes 143543l and subsequent and airplanes having Service Change No. 449 complied with.	250 volts ac or 300 volts dc, depending on whether a-c or d-c gun firing units are used.	Replace electrical wiring to gun electrical disconnects.
		Zero volts.	Continue trouble shooting.
	Check between test points AFN and AFP and ground, between test points AFQ and AFR and ground or between test points AFS and AFT and ground as required.	250 volts ac or 300 volts dc at test points AFN, AFQ, AFS and AFU; 28 volts dc only at test points AFP, AFR, AFT and AFV.	Replace defective gun firing control units, Aero 2A (a-c) or Aero 1B (d-c), as required.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ONE OR MORE GUNS FAIL TO FIRE. (Cont)			
Defective gun firing control units, Aero 2A (a-c) or Aero 1B (d-c). (Cont)	Check between test points AFN and AFP and ground, between test points AFQ and AFR and ground or between test points AFS and AFT and ground as required.	Zero volts at test point AFN, AFG, AFS or AFU.	Refer to probable cause, "Defective Gun Power Supply or Jumper Plug."
		Zero volts at test point AFP, AFR, AFT or AFV.	Refer to probable cause, "Defective GUN FIRING Relay, GUN CONTROL Switch or Gun Trigger Switch."
Defective gun power supply or jumper plug.	Check between test point AFW, AFX, AFY or AFZ and ground as required.	115 volts ac.	Replace defective gun power supply or jumper plug as required.
		Zero volts.	Refer to probable cause, "Defective GUN AC POWER Relay or GUN CONTROL Switch."
Defective GUN AC POWER relay or GUN CONTROL switch.	Check between test point AA or AB and ground. **Note** Use test point AY or AZ for airplanes 141467j and subsequent.	115 volts ac.	Replace defective wire to test point AFW, AFX, AFY or AFZ as required.
		Zero volts.	Continue trouble shooting.
	Check between test points AE, XAF and XCN and ground.	115 volts ac at test point XCN. 28 volts dc at test point AE.	Replace defective GUN AC POWER relay or attached wiring as required.
		Zero volts at test point XAF or XCN.	Refer to paragraph 8-78, Trouble Shooting A-C Power Supply and Distribution System.
		Zero volts at test point AE.	Continue trouble shooting.
	Check between test points ACB and AF and ground.	28 volts dc.	Replace defective wiring to test point AE.
		Zero volts at test point ACB.	Replace defective GUN CONTROL switch.
		Zero volts at test point AF.	Continue trouble shooting.
	Check between test point PCE and ground.	28 volts dc.	Replace defective circuit breaker or wire to test point AF.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
Defective GUN FIRING relay, GUN CONTROL switch or gun trigger switch.	Check between test point AG, AH, AJ or AK and ground as required. **Note** On airplanes 141467j and subsequent, use test points AAA and AAB and ground.	28 volts dc.	Replace defective wire to test point AFP, AFR, AFT or AFV as required.
		Zero volts.	Continue trouble shooting.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ONE OR MORE GUNS FAIL TO FIRE. (Cont)			
Defective GUN FIRING relay, GUN CONTROL switch or gun trigger switch. (Cont)	Check between test points AN, AP and AQ and ground. **Note** Insert a jumper between "B" pins of the separated No. 52 pedestal disconnect.	28 volts dc.	Replace defective GUN FIRING relay or attached wiring as required.
		Zero volts at test point AN or AP.	Replace defective GUN SELECTOR switches or attached wiring as required, or refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
		Zero volts at test point AQ.	Continue trouble shooting.
	Check between test points AR and AS and ground. **Note** Remove jumper between "B" pins of the separated No. 52 pedestal disconnect and connect disconnect.	28 volts dc.	Replace defective wire to test point AQ.
		Zero volts at test point AR.	Replace defective GUN CONTROL switch.
		Zero volts at test point AS.	Continue trouble shooting.
	Check between test points AT, BK and ground.	28 volts dc.	Replace defective wire to test point AS.
		Zero volts at test point AT.	Replace defective pilot's stick grip assembly.
		Zero volts at test point BK.	Replace defective BOMB & GUN TRIGGER circuit breaker or attached wiring as required, or refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.

TEST EQUIPMENT: None.

SYSTEM CONDITIONS: Ammunition removed.
ARM MASTER switch in "OFF" position.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
INDIVIDUAL GUNS FAIL TO FIRE.			
Defective cartridge primer.			Charge guns to remove defective round from gun.
Open or shorted gun firing circuit.	Perform gun circuit voltage check and continuity check. (Refer to paragraphs 7-34 through 7-36.)		Replace defective gun components.
Broken firing pin, firing pin guide or firing pin spring.	Visually check pin at face of bolt and perform gun circuit continuity check. (Refer to paragraphs 7-34 and 7-35.)		Replace defective gun firing pin assembly.
Dirt or oil on firing contacts, breechblock contacts, firing pin or contact assembly.	Visually check components for excessive dirt or oil and perform gun circuit continuity check. (Refer to paragraphs 7-34 and 7-35.)		Clean and/or replace defective gun components.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
INDIVIDUAL GUNS FAIL TO FIRE. (Cont)			
Broken or bent bolt contact squib.	Visually check contact squib and perform gun circuit continuity check. (Refer to paragraphs 7-34 and 7-35.)		Replace synchronizing switch and squib.
Repeated breaking or bending of bolt contact squib.	Check for presence of shims under contact assembly. Two 0.040-inch shims should be used under contact assemblies mounted on guns having a milled-out area extending along the side of the receiver and under the contact assembly. No shims are required on guns on which the milled-out area does not extend under the contact assembly.		Insert or remove shims as necessary.
Gun contact switch assembly loose on gun.	Inspect for presence of a 0.020-inch steel shim under mount screw heads.		Add shim if necessary.
Breechblock not returning to battery.	Visually check gun for damaged parts.		Replace damaged gun components.
Gun jammed.	Visually inspect gun.		Charge guns to clear jammed round.
AMMUNITION FAILS TO FEED PROPERLY.			
Improper adjustment of feeder mechanism on gun receiver.	Visually check for proper adjustment dimensions between aft end of feed throat flange and "V" groove on gun receiver.		If gun receiver has one "V" groove witness line, adjust feeder to proper dimension. (Refer to paragraph 7-23.) If gun receiver has two "V" groove alignment lines, align the alignment line near the aft end of feeder housing flange with forward "V" groove. (Refer to paragraph 7-23.)
Broken feeder drive spring.	Turn feeder winding shaft to determine whether or not spring torque is present.		Replace feeder mechanism.
Broken or damaged feeder mechanism parts.	Visually inspect feeder mechanism.		Replace feeder mechanism or components.
Broken gun receiver trunnion or feeder tie rods.	Visually inspect gun for broken components.		Replace defective gun components.
Broken ammunition belt or ammunition jam in ammunition container or feed chute.	Visually inspect ammunition belt.		Reposition ammunition belt and refeed into feeder.
Feeder mechanism entrance set at improper angle.	Visually check angle of feeder entrance. Outboard gun feeder entrance should be set 10 degrees below horizontal and inboard feeder should be set 15 degrees above horizontal.		Reset feeder entrance angle. (Refer to paragraph 7-23.)

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
AMMUNITION FAILS TO FEED PROPERLY. (Cont)			
Improper leading link on ammunition belt.	Visually check leading link. For left-hand guns, the leading link must be a double link; for right-hand guns, a standard link may be used.		Install proper leading link.
Faulty or damaged pneumatic charger or buffer assembly.	Visually check buffer and charger assemblies for damage. With electrical power on the armament bus and GUN CHARGING circuit breaker engaged, position GUN CONTROL switch to "READY" and back to "SAFE." Charger should cycle breechblock freely without sticking. Loosen air bleeder plug on aft end of buffer assembly to check buffer action.		Replace faulty or damaged charger or buffer components.
Faulty or damaged gun gas mechanism.	Visually check gun gas mechanism for damage. Check the breechblock slide push-pull rods for burrs and peening. Check cylinder vent plug for fouling or erosion.		Replace damaged or faulty components.
Insufficient pneumatic pressure.	Check pneumatic pressure gages in pneumatic compartment for correct operating pressure.		Check pneumatic power system for correct operation. (Refer to paragraph 7-48.)
EXPENDED CASES FAIL TO EXTRACT PROPERLY.			
Broken extractor or extractor spring.	Visually check extractor and spring.		Replace extractor and/or spring.
Excessive oil and dirt in firing chamber.	Visually inspect firing chamber.		Charge or ram out expended case and clean firing chamber. Make certain firing chamber grooves are clean.
EXPENDED CASES FAIL TO EJECT PROPERLY.			
Broken ejector or ejector springs.	Visually inspect ejector and the four ejector springs.		Replace ejector and/or ejector spring or replace feeder.

7-7A. TROUBLE SHOOTING AMMO BOOSTER SYSTEM—AIRPLANES 139531i AND SUBSEQUENT NOT HAVING SERVICE CHANGE NO. 493 COMPLIED WITH.

TEST EQUIPMENT: D-C voltmeter.

SYSTEM CONDITIONS: Ammunition removed.
28-volt d-c external power applied.
BOMB & GUN TRIGGER, AMMO BOOST & GUN CAMERA and all four AMMO BOOST circuit breakers engaged.
GUN CONTROL switch to "SAFE" position.
Armament bus energized.
Gun trigger switch depressed and maintained at first detent.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
GUN(S) FAILS TO FIRE.			
Defective ammo booster.	Check between test point ABA, ABB, ABC or ABD and ground as required.	28 volts dc.	Replace defective ammo booster.
		Zero volts.	Continue trouble shooting.
Defective gun booster(s).	Check between test points ABE and ABF and ground, between ABG and ABH and ground, between ABJ and ABK and ground or between ABL and ABM and ground.	28 volts dc.	Replace defective wire to test point ABA, ABB, ABC or ABD.
		Zero volts between test point ABE, ABG, ABJ or ABL and ground.	Replace defective relay(s) or attached power wire as required.
		Zero volts between test point ABH, ABK or ABM and ground.	Replace defective wire as required.
		Zero volts between test point ABF and ground.	Continue trouble shooting.
Defective ammo boost relays.	Check between test points BJ and BK and ground.	28 volts dc.	Replace defective AMMO BOOST & GUN CAMERA circuit breaker or attached wiring.
		Zero volts at test point BK.	Refer to paragraph 7-7, Trouble Shooting Gunnery System.
		Zero volts at test point BJ.	Replace defective pilot's stick grip assembly.
Defective AMMO BOOST circuit breakers.	Check between test points PCA, PHA, PHB, PHC, and PHD and ground.	28 volts dc.	Replace defective circuit breaker as required.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
Faulty ammunition boost motor overfeed cam. Inoperative or binding ammunition boost motor.	Visually check ammunition boost unit. Check to see that overfeed cam does not remain engaged with overfeed microswitch. Check ammunition boost motor by engaging BOMB & GUN TRIGGER and AMMO BOOST & GUN CAMERA circuit breakers with electrical power on armament bus. Engage the AMMO BOOST circuit breaker corresponding to the boost motor to be checked. Depress gun trigger switch to first detent to operate boost motor. **Note** To prevent gun camera from operating simultaneously with ammunition boost units, disconnect camera electrical plug from receptacle on body of camera unit.		Replace ammunition boost unit.

7-7B. TROUBLE SHOOTING AMMO BOOSTER SYSTEM — AIRPLANES 139531i AND SUBSEQUENT HAVING SERVICE CHANGE NO. 493 COMPLIED WITH.

TEST EQUIPMENT: D-C voltmeter.

SYSTEM CONDITIONS: Ammunition removed.
28-volt d-c external power applied.
BOMB & GUN TRIGGER, AMMO BOOST & GUN CAMERA and all four AMMO BOOST circuit breakers engaged.
GUN CONTROL switch to "READY" position.
Armament bus energized.
Gun trigger switch depressed and maintained at first detent.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
GUN(S) FAILS TO FIRE.			
Defective ammo booster motor monitor control relay.	Check test points ABF, ABP, ABQ and ABN to ground.	28 volts dc at all test points.	Refer to probable cause, "Defective Ammo Boost Relays," in paragraph 7-7A.
		Zero volts at test points ABF and ABQ. 28 volts dc at test points ABP and ABN.	Replace defective ammo booster motor monitor control relay.
Defective ammo booster motor monitor control relay power control circuit.	Check test points PCE and ACB to ground.	Zero volts at test point ACB. 28 volts dc at test point PCE.	Replace defective wire segment, GUN CHARGING circuit breaker or GUN CONTROL switch.
		Zero volts at both test points.	Refer to probable cause, "Defective GUN AC POWER Relay or GUN CONTROL Switch," in paragraph 7-7.
Defective ammo boost relay control circuit.	Check test points ABP and PCA to ground.	Zero volts at test point ABP. 28 volts dc at test point PCA.	Replace defective wire segment or circuit breaker as required.
		Zero volts at both test points.	Refer to POWER FAILURE, in paragraph 7-127.

7-8. GUNS.

7-9. The 20mm Mark 12 Mod 3 automatic aircraft guns are combination blow-back and gas-operated weapons designed to fire electrically primed ammunition at a rate of 900 to 1000 rounds per minute in short bursts. The bolts are unlocked and opened by gas pressure and blow-back and are returned to the closed position by a pneumatic buffer. The complete gun consists of the barrel assembly, the recoil mechanism assembly, the receiver assembly, the breechblock assembly, the charger assembly, the gas mechanism assembly, the buffer assembly and the contact assembly. Threads on the breech end of the tubular steel alloy barrel mate with threads in the receiver. A locking pin is inserted through the underside of the receiver into a locking pin hole in the aft end of the barrel. The receiver assembly houses or supports all working parts of the gun mechanism and provides attaching surfaces for the feeder mechanism. The breechblock assembly loads the round into the firing chamber, closes the breech, fires the round and removes the empty cartridge case. Gas pressure, through the gas mechanism, unlocks the breechblock and starts it rearward immediately after the round is fired. The recoil mechanism checks the movement of the recoiling parts of the gun mechanism and returns them to battery. In addition, the pneumatic buffer assembly buffs and stops the rearward movement of the breechblock and returns it to battery. The pneumatic charger assembly provides for remote controlled power operation of the breechblock for first round loading and for round clearing. The gun is electrically fired and will continue to fire as long as the firing circuit is closed and ammunition is available.

7-10. CLEANING AND LUBRICATING GUNS. The guns should be cleaned and lubricated as soon as possible after firing and at regular intervals thereafter. Powder fouling, dirt and gummed oil cause rapid deterioration of all parts. Special attention should be given the barrel, bolt and other parts primarily affected by powder fouling. Clean the barrel, bolt and slides and the forward

portion of the receiver with rifle bore cleaner (item 19, materials list). Gloves should be worn by personnel handling and cleaning guns to prevent perspiration from corroding the metal. Wipe parts dry with a clean cloth and lubricate with a thin film of oil (item 79, materials list). Clean recoil mechanism, buffer assembly and charger assembly with Stoddard Solvent (item 119, materials list). Wipe dry with a clean cloth and lubricate with a film of oil (item 79, materials list). If buffer and charger assemblies are disassembled, lubricate the "O" rings and backup rings with grease (item 85, materials list). Check the components of the gas mechanism assembly for erosion and fouling. Powder fouling may be removed with rifle bore cleaner (item 19, materials list). Remove powder fouling and carbon from gas cylinder vent plug and barrel gas port. Carbon may be reamed from barrel gas port.

Note

> In removing carbon from barrel gas port, do not use any tool that will scratch or mar the cylinder walls of the port.

Coat the outer surfaces of the entire gun assembly with a thin film of oil (item 79, materials list). For gun and gun feeder periodic lubrication requirements, refer to paragraph 1-53.

7-11. MAINTAINING GUNS DURING EXTREME ATMOSPHERIC CONDITIONS. Extremely cold, hot, dusty, wet or salty atmospheric conditions increase the tendency of metal parts to rust, corrode and wear excessively. Lubricating agents are less effective under such conditions. Consequently, additional gun maintenance, inspection, cleaning and lubrication are necessary to keep the guns and related equipment in satisfactory operating condition.

7-12. MAINTAINING GUNS IN EXTREME COLD WEATHER. Keep the moving parts of the gun and its components free of moisture and excessive oil. Moisture and excessive oil on the moving parts will solidify and cause sluggish operation or complete failure. Particular attention should be given the barrel bore, the breechblock slide assembly, the bolt assembly, the firing pin guide and the breechblock lock. Keep the breech and firing mechanism extremely clean. Lubricate lightly and wipe all excess lubricating agent from the gun mechanism. Frequently check gun and gun feeder mechanism for sluggish operation.

7-13. MAINTAINING GUNS IN EXTREME HOT WEATHER. High temperatures and high humidity quickly dissipate the protective oil film necessary to prevent rusting and corrosion. Inspect guns and related components frequently and relubricate all parts as often as necessary to maintain a protective oil film. Perspiration from the hands is a contributing factor to metal corrosion. Wipe handled guns dry and lubricate as soon as possible after handling. Frequently inspect unexposed surfaces such as the barrel bore and chamber and the breechblock assembly where moisture condensation might cause rusting.

7-14. MAINTAINING GUNS IN EXTREME SANDY OR DUSTY ATMOSPHERIC CONDITIONS. In localities where dust and sand storms are prevalent, the gun blast tubes should be plugged and the gun muzzle tampions installed any time the airplane is on the ground. Otherwise, dust and sand may enter the mechanism and bore and adhere to lubricated surfaces, forming a gummy paste that may clog the gun and cause malfunctioning. Dust and sand also act as abrasives, increasing the wear of moving parts of the gun mechanism. The guns should be disassembled and thoroughly cleaned, inspected and lubricated following any severe dust or sand storm.

7-15. MAINTAINING GUNS DURING MOIST OR SALTY ATMOSPHERIC CONDITIONS. Salt and moisture quickly destroy the rust preventive qualities of lubricating agents and increase the possiblity of rust and corrosion occurring. Clean and lubricate all moving parts and exposed metal surfaces of the gun and related components as often as necessary to maintain the protective oil film. Frequently check all gun components for corrosion.

7-16. GUN FEEDER MECHANISM.

7-17. Each gun is equipped with a Mark 9 recoil-operated mechanical feeder assembly (paragraph 7-23) mounted on top of the gun receiver. Right-hand guns require the Mark 9 Mod 4 feeder assembly and left-hand guns require the Mark 9 Mod 5 assembly. The Mod 4 feeder assembly is designed to feed ammunition from the right-hand side while the Mod 5 assembly feeds ammunition from the left-hand side. Two feeder tie rods attached to the gun trunnion provide for mounting and adjusting the feeder assembly. A feeder cam driving pin engages a hole near the aft end of the gun receiver. The feeder assembly, consisting of feedway, driving and winding components, draws belted ammunition into the feedway where the feeder star wheels engage each round. The ammunition link is stripped from each round by the action of the stripping cams, a stripping finger and a "T" rail. Stripped links are guided out of the feedway into the link chute. Continued rotation of the star wheels brings the round down into bolt pickup position. The feeder assembly power spring is initially wound by hand during the ammunition loading operation. Thereafter, the recoil and counter-recoil cycles of the gun actuate the feeder cam driving pin and maintain feeder power spring wind.

Note

> Never fully wind the feeder assembly power spring with a round in the chamber of the gun. Never wind the feeder assembly power spring with the bolt in the aft position. Otherwise, an overwound power spring or breakage will result.

A release control knob on the forward end of the feeder assembly permits manual release of the power spring

torque. Power spring torque must be released prior to removing the feeder assembly from the gun, clearing ammunition jams in the gun and feeder or unloading ammunition. The feed entrance table angle is adjustable from 20 degrees below horizontal to 30 degrees above horizontal to facilitate feed and link chute installations. Serrations on the adjustment arm may be used as an index for setting the desired angle. Ammunition feed and link chutes are attached by pins on each side of the feed entrance and are secured by the feeder cover lockpins.

7-18. GUN BLAST PANELS AND TUBES.

7-19. Stainless steel blast tubes attach to each gun muzzle stabilizer retainer by means of a ball and socket type floating joint. The blast tubes extend forward through recessed ports in the titanium gun blast panels. The gun blast panels form a section of the airplane fuselage skin.

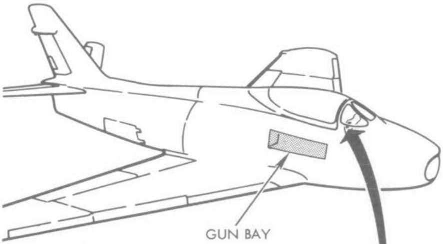
CAUTION

Do not fire guns without blast tubes and blast panels installed due to possible collapse of or damage to inlet duct.

7-20. GUN MUZZLE STABILIZERS.

7-21. Each gun is equipped with a gun muzzle stabilizer to prevent barrel whip. The gun muzzle stabilizer assembly consists of a mounting and adjustment plate, a floating bearing and a retainer. When installed, the gun muzzle extends through the bearing. Elongated slots in the mounting and adjustment plate and in the airplane mounting structure allow for adjustment of the muzzle stabilizer in any direction. The component parts of the muzzle stabilizer assembly are machined to mate correctly with each other and are not interchangeable between assemblies. If a part of the muzzle stabilizer assembly requires replacement, the entire stabilizer assembly should be replaced. The gun blast tube mounts to the stabilizer assembly retainer.

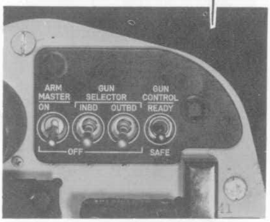
7-22. REMOVING AND INSTALLING GUNS.



REMOVING

1 Remove electrical power from airplane electrical system.

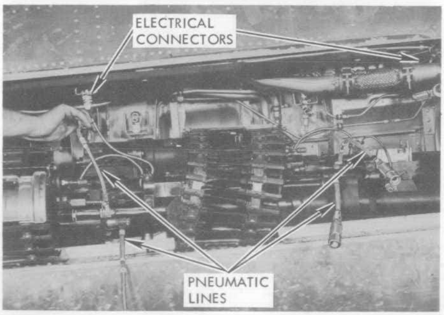
2 Make certain all armament system switches are positioned to "OFF."



3 If gunnery system is loaded, unload ammunition. (Refer to paragraph 7-38.)

4 Remove gun bay access door from airplane. Door may be stowed on stowing retainers immediately above gun bay if desired.

5 Disconnect both gun contact assembly plugs from electrical receptacles.

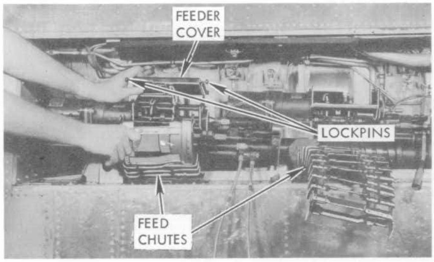


6 Disconnect all pneumatic lines at quick-disconnects.

FJ-4B-2-61-53

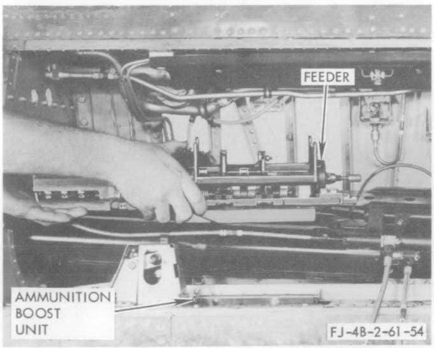
Note A bleed-off safety feature is incorporated in the pneumatic quick-disconnects. Turn connector one-half turn counterclockwise and back off connector until a stop is encountered. Air pressure in line will then bleed off without blowing line and connector off receptacle. After pressure has bled off, continue turning connector counterclockwise and pull free of receptacle.

7 Depress lockpins and remove covers from feeder units.

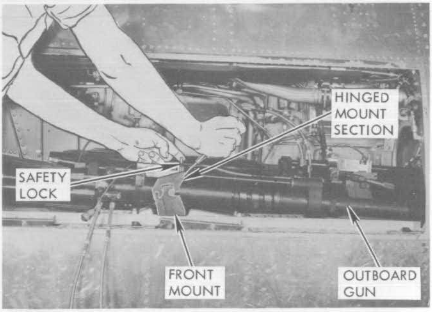


8 Disengage link chute and feed chute from each feeder. Pull link chutes out of chute guides and remove from airplane. Disengage feed chutes from ammuniton boost units and remove chutes from airplane.

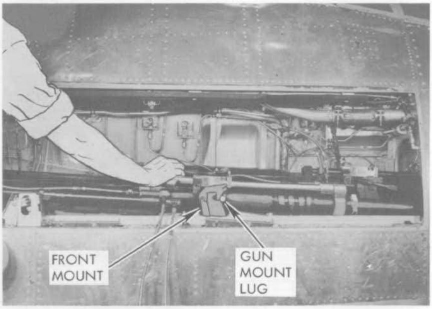
9 Remove feeder units from guns. (Refer to paragraph 7-23.)



FJ-4B-2-61-54

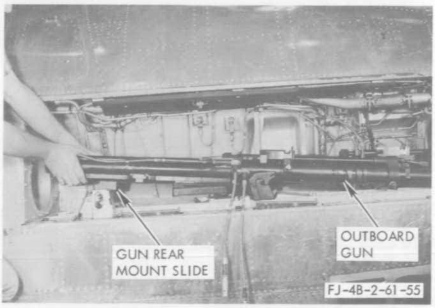


10 Hold outboard gun front mount safety locks in unlocked position and rotate hinged section of mount up to free gun mount lugs.



11 Slide outboard gun forward sufficiently to disengage gun from front and rear mounts.

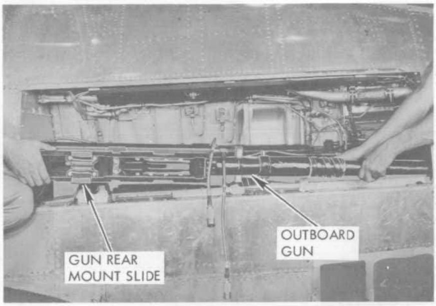
12 Lift gun free of obstructions and move aft, swinging aft end out of gun bay and disengaging muzzle from muzzle stabilizer.



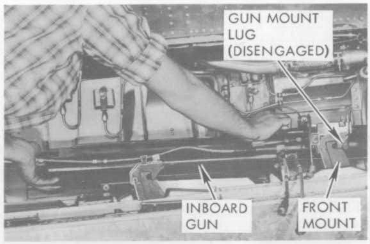
FJ-4B-2-61-55

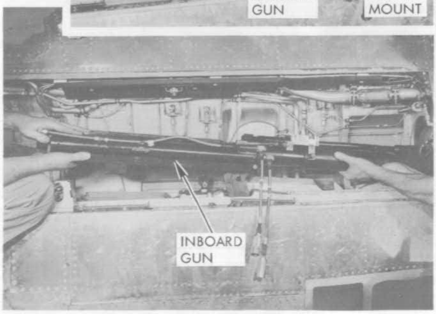
Note In order to clear aft outboard edge of gun bay, it will be necessary to rotate gun so that mount slide at aft end of receiver is facing outboard.

13 Remove gun from airplane.



14 Remove inboard gun from airplane in the same manner. It is not necessary to rotate inboard gun during removal to clear aft edge of gun bay.



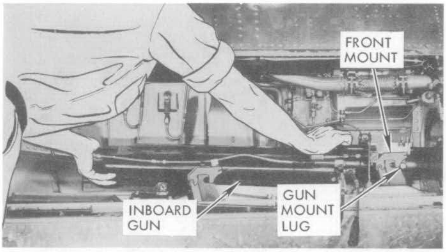


15 If guns are to be left out of airplane, cap pneumatic receptacles to prevent foreign matter from entering system.

FJ-4B-2-61-56

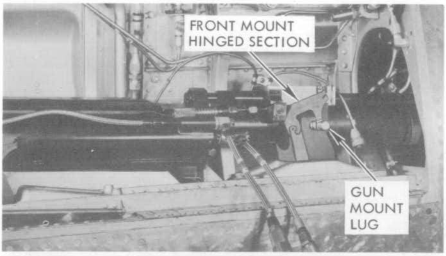
INSTALLING

1 Place inboard gun in gun bay, guiding gun muzzle into inboard muzzle stabilizer and sliding gun forward until front mount lugs are forward of front mount.



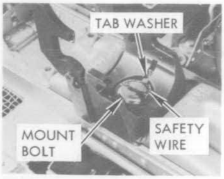
Note Leave front mount hinged sections down until gun is positioned with mount lugs forward of front mount.

2 Move gun aft, raising hinged sections of front mount at same time. Engage gun with rear mount and continue to move gun aft until front mount lugs are seated in front mount.



3 Lower hinged sections of front mount, making sure mount is fully engaged and safety locks are extended.

Note If front gun mount is replaced, or a new mount is installed, difficulty may be experienced in aligning mount so that both gun mount lugs seat fully. If both gun mount lugs do not seat fully, insert a heavy bar through blast panel opening and place against mount. Hammer bar to align mount.

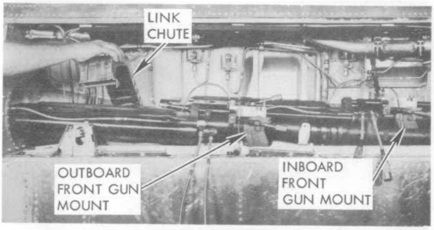


Note When installing front gun mounts, outboard mount requires long mount bolt, while inboard mount uses a shorter mount bolt. Torque mount bolts to 100 foot-pounds and safety with tab washer and AN995F41 safety wire.

FJ-4B-2-61-57

4 Install outboard gun in the same manner.

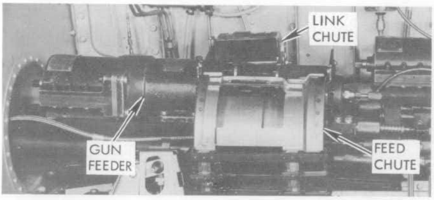
5 Install link chutes in chute guides, allowing link chute to slide down until chute mouth is just above gun receiver.



Note Install link chutes with beveled end of chute sections toward inner circumference of chute bend.

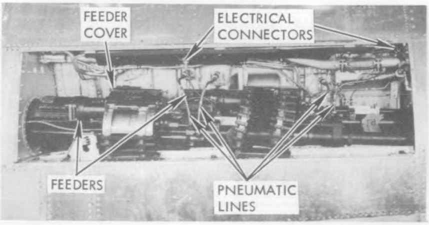
6 Install feeders on guns. (Refer to paragraph 7-23.)

7 Install ammunition feed chutes, connecting feed and link chutes to feeder throat. Install gun feeder covers.



8 Connect gun pneumatic charger lines to pneumatic disconnects in gun bay.

9 Connect gun contact assembly plugs to electrical receptacles.



10 Load ammunition if desired. (Refer to paragraph 7-37.)

11 Install gun bay access door.

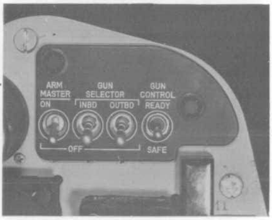
FJ-4B-2-61-58

7-23. REMOVING, INSTALLING AND ADJUSTING GUN FEEDER MECHANISM.

REMOVING

1 Remove electrical power from airplane electrical system.

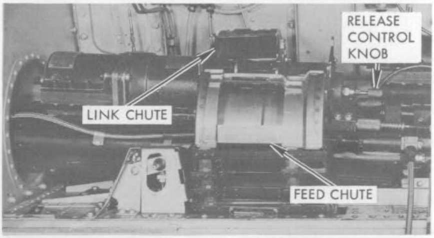
2 Make certain all armament switches are positioned to "OFF."



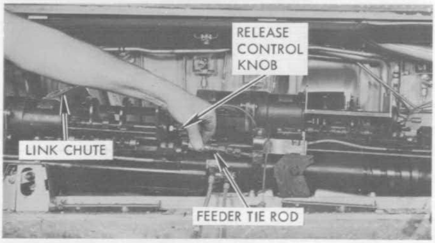
3 Remove gun bay access door.

4 Remove feeder cover and disengage feed and link chutes from feeder.

5 If gunnery system is loaded, unload ammunition. (Refer to paragraph 7-38.)

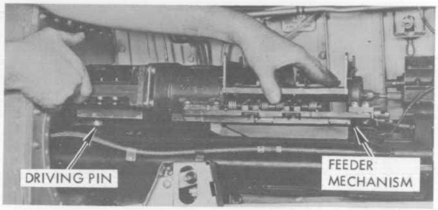


6 Release feeder drive spring torque by depressing release control knob on forward end of feeder mechanism.



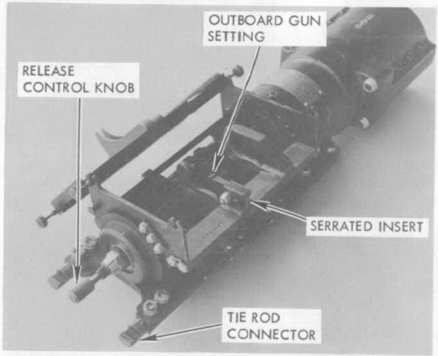
7 Pull tie rod retaining sleeves back and release tie rods from feeder mechanism.

FJ-4B-2-61-59

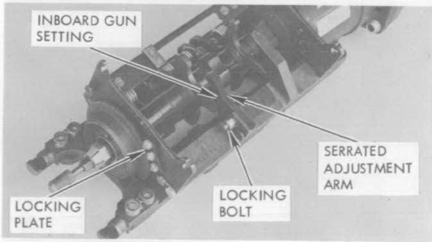


8 Slide feeder mechanism back slightly to clear guides and raise off gun receiver. Remove from airplane.

INSTALLING - ADJUSTING

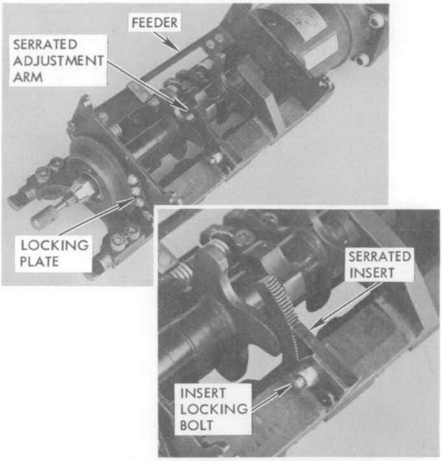


1 Prior to installing feeder mechanism, check angle of feed entrance. Feed entrance of feeder for outboard gun is set 10 degrees below horizontal. Feed entrance of feeder for inboard gun is set 15 degrees above horizontal.



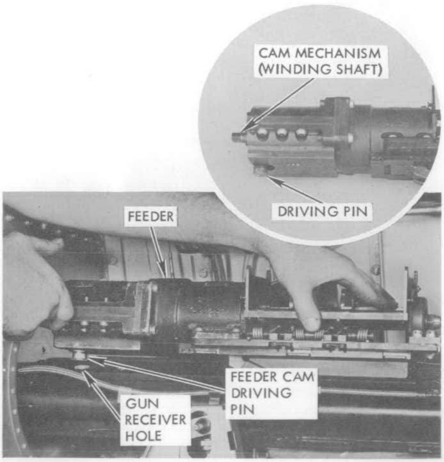
2 To set feed entrance angle, remove locking plate at forward end of feeder and remove locking bolt and serrated insert at center of feedway. To set outboard feeder to 10 degrees down, set serrated insert to number three tooth on the serrated adjustment arm. To set inboard feeder to 15 degrees up, set serrated insert to number 15 tooth on adjustment arm. Count teeth from top of arm down. Settings may be varied one tooth either way, if necessary, to align locking plate on end of feeder.

FJ-4B-2-61-60



3 Install locking plate on forward end of feeder and install bolt through serrated insert at center of feedway.

Note Do not install washer under nut on insert locking bolt. Torque nut so that flat side of nut is perpendicular to bottom of feeder; otherwise nut will interfere.

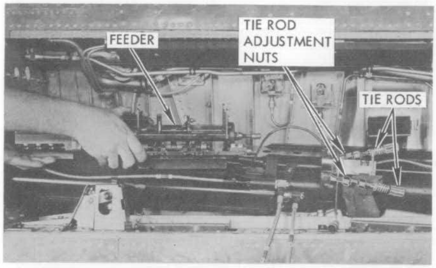


4 Before installing feeder mechanism, move recoil cam to its maximum forward position. This may be done by tapping the cam mechanism as it protrudes from the aft end of the feeder housing. Moving cam forward will allow cam driving pin to be more readily inserted in the driving hole in gun receiver.

FJ-4B-2-61-61

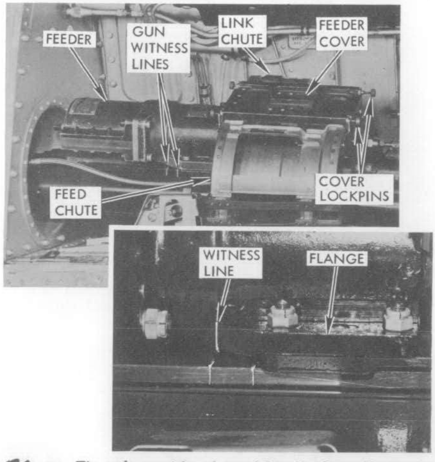
5 Throw gun tie rods back toward muzzle end of gun to prevent interference with feeder mechanism as it is installed.

6 Place feeder mechanism on gun, engaging feeder cam driving pin with hole in gun receiver.



7 Slide feeder forward into position and attach gun tie rods to feeder.

8 Adjust tie rods through adjustment nuts at center of tie rod assembly so that "V" groove on angled face of feeder is in line with aft "V" groove on gun receiver.



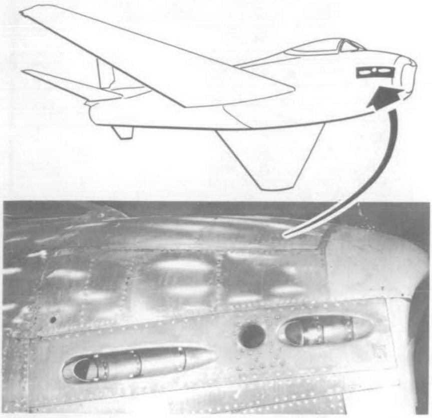
Note Tie rods must be of equal length after adjustment to assure proper centering of feeder on gun receiver and to assure equal sharing of load between the two tie rods.

9 Engage feed and link chutes with chute retaining pins on each side of feeder throat. Install feeder cover.

10 Install gun bay access door.

FJ-4B-2-61-62

7-24. REMOVING AND INSTALLING GUN MUZZLE STABILIZERS, BLAST TUBES AND BLAST PANELS.

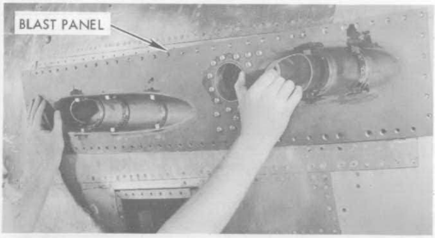


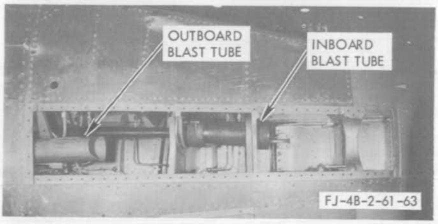
REMOVING

Warning Check to make certain that gunnery system is disarmed and electrical power is removed from armament bus.

1 Remove screws from gun blast panel.

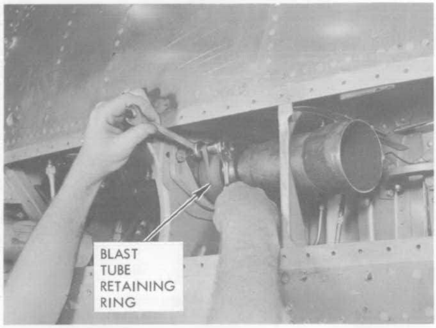
2 Slide blast panel forward to disengage blast tubes and remove panel from airplane.



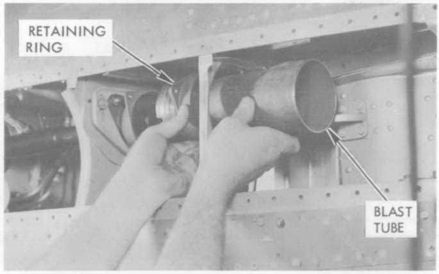


FJ-4B-2-61-63

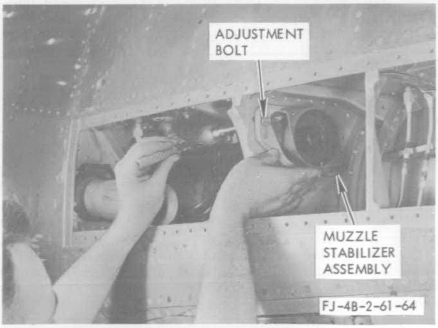
3 Remove two bolts from blast tube retaining ring.



4 Remove blast tube and retaining ring from airplane.

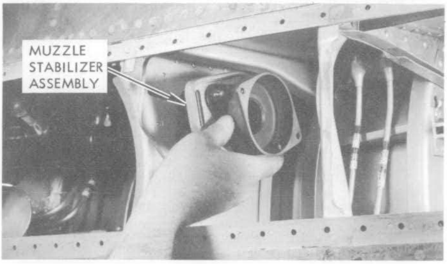


5 Remove two muzzle stabilizer adjustment bolts.

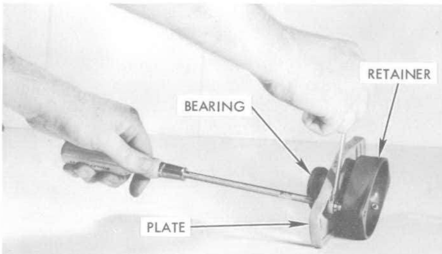


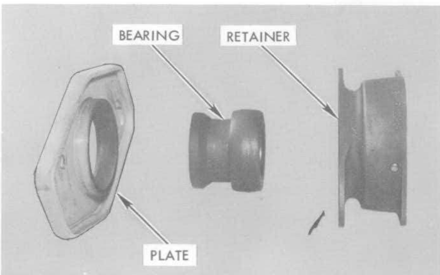
FJ-4B-2-61-64

6 Remove muzzle stabilizer assembly from airplane.



7 Remove bolts from stabilizer assembly and separate bearing, retainer and plate.

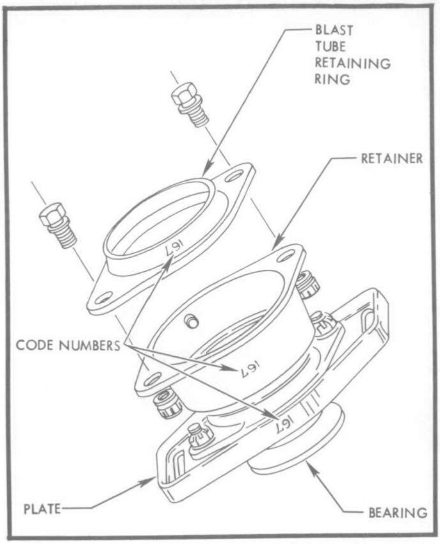




INSTALLING

Caution The muzzle stabilizer assembly is a matched assembly and all component parts must remain together. The stabilizer assembly plate, retainer and blast tube retaining ring are identified by a code number stamped on one side of each part. The code numbers of all parts must match and must be in line with each other when assembly is installed.

FJ-4B-2-61-65



1 Assemble retainer, bearing and plate, making sure code numbers match and line up. Safety nuts with cotter pins.

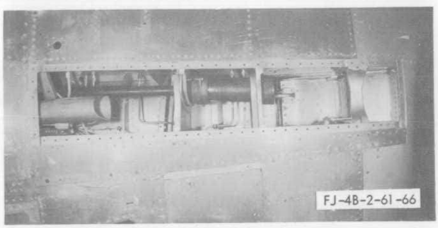
2 Place stabilizer assembly in mounting position, center around gun muzzle and install adjustment bolts.

Note Check to be sure retainer allows free angular movement of bearing. Axial movement of bearing shall not exceed 0.015 inch.

3 Install blast tube and retaining ring on muzzle stabilizer and install bolts. Safety nuts with cotter pins. Make sure code number on retaining ring matches and lines up with those on the stabilizer assembly parts.

Note Check angular movement of blast tube. Installation must allow freedom of angular movement; however, axial movement of blast tube shall not exceed 0.025 inch.

4 Engage blast tubes in blast panel ports and slide panel aft to mounting position. Install mounting screws.



FJ-4B-2-61-66

7-25. AMMUNITION BOOST MOTORS.

7-26. Each gun is equipped with an electrical ammunition boost motor (figure 7-7) mounted between the ammunition bay and the gun bay. The boost motor star wheels engage belted ammunition from the ammunition container and feed the ammunition through the boost motor housing and ammunition feed chute to the mechanical feeder. The boost motor is equipped with an overfeed cam, a torque-limiting or overfeed switch and two 2-ohm resistors wired in parallel. If the boost motor feeds ammunition at a rate greater than the gun can fire, the resultant pressure of the ammunition in the feed chute above the motor will cause the overfeed cam to rotate and actuate the overfeed switch. The overfeed switch will then direct current through the resistors, reducing boost motor voltage and slowing down the motor. As soon as pressure from the overfeed condition decreases, the overfeed cam rotates away from the overfeed switch, allowing the booster motor to resume normal operation.

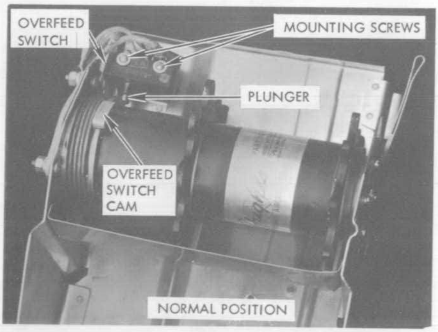
Note

For adjustment of the ammunition boost motor overfeed switch, refer to paragraph 7-27.

An anti-rollback release handle on each boost motor unit extends up into the gun bay. Pulling the release handle disengages the boost motor clutch and allows ammunition to be pulled in reverse through the boost motor star wheels.

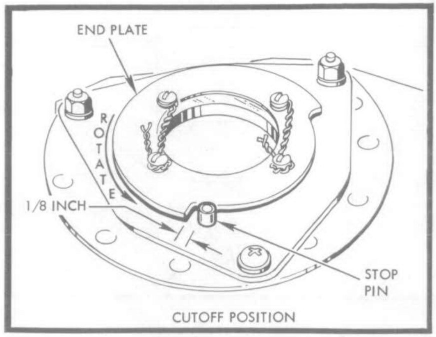
7-27. ADJUSTING AMMUNITION BOOST MOTOR OVERFEED SWITCH.

1 Loosen mounting screws of overfeed switch.



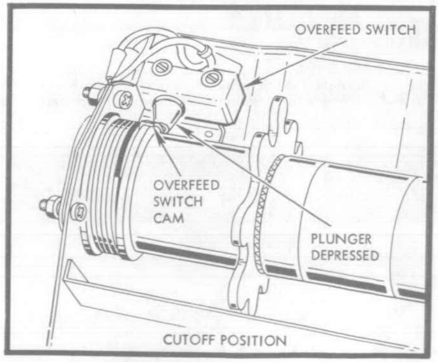
FJ-4B-2-61-68

2 Rotate end plate counterclockwise until there is a minimum of 1/8-inch space between the stop pin and the end plate. This locates the overfeed switch cam in the cutoff position.



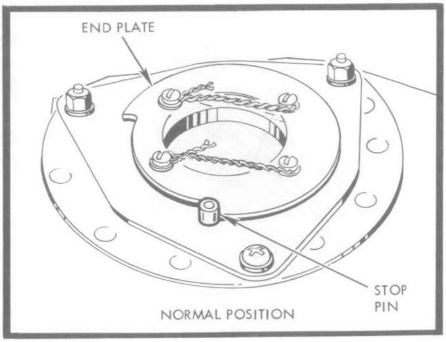
3 Move the switch toward the cam until the switch plunger clicks.

4 Tighten the switch mounting screws.



FJ-4B-2-61-69

5 Return end plate slowly clockwise to normal position.



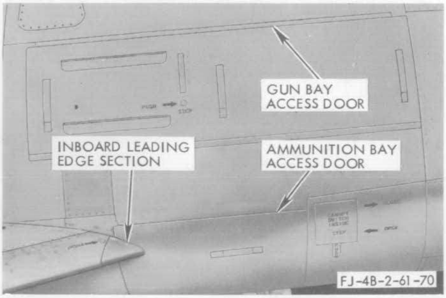
FJ-4B-2-61-94

7-28. REMOVING AND INSTALLING AMMUNITION BOOST UNITS.

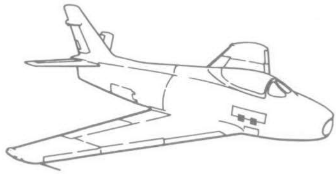
REMOVING

1 Remove electrical power from airplane electrical system.

Note Inboard leading edge section must be lowered in order to open ammunition bay access door.



FJ-4B-2-61-70



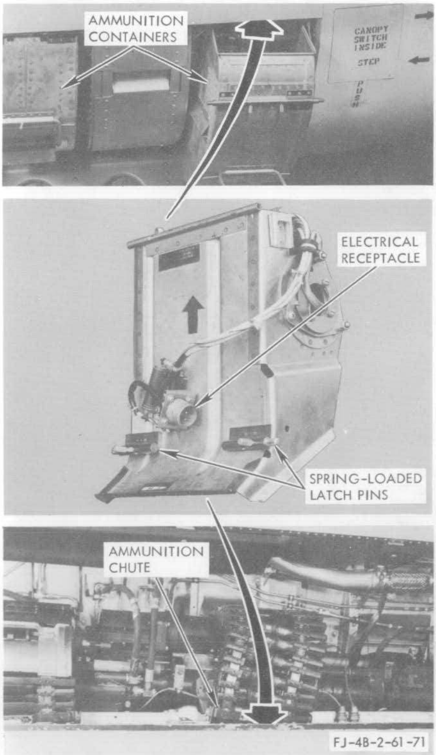
2 Open ammunition bay access door and remove gun bay access door.

3 Remove ammunition containers from ammunition bay to gain access to boost unit.

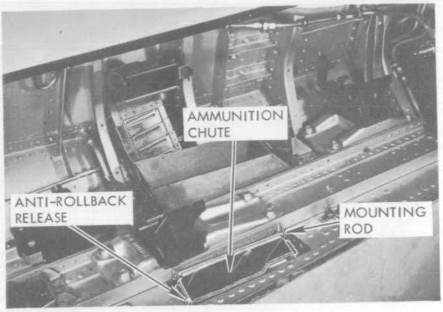
4 Disconnect electrical plug from electrical receptacle on back of boost unit.

5 Unlatch spring-loaded latch pins at lower end of back of boost unit.

6 Remove retaining pin from end of mounting rod passing through boost unit at inboard side of mouth.



FJ-4B-2-61-71



7 Pull mounting rod free of unit while providing support for unit.

8 Remove unit through ammunition bay.

INSTALLING

1 Place unit in mounting position; install through ammunition bay.

2 Install mounting rod through mounting brackets and unit flange at inboard side of mouth. Install retaining pins in ends of mounting rod.

3 Align spring-loaded latch pins on back of boost unit with holes in mounting brackets and latch into position. Make sure latch pins are fully inserted into mounting bracket holes and latch pin handles are down in locked position.

4 Connect electrical plug to electrical receptacle on back of boost unit and safety-wire with AN995F32 wire.

5 Install ammunition containers in ammunition bay and close ammunition bay access door. Install gun bay access door.

FJ-4B-2-61-72

7-29. GUN FIRING CONTROL UNITS AND JUMPER PLUGS.

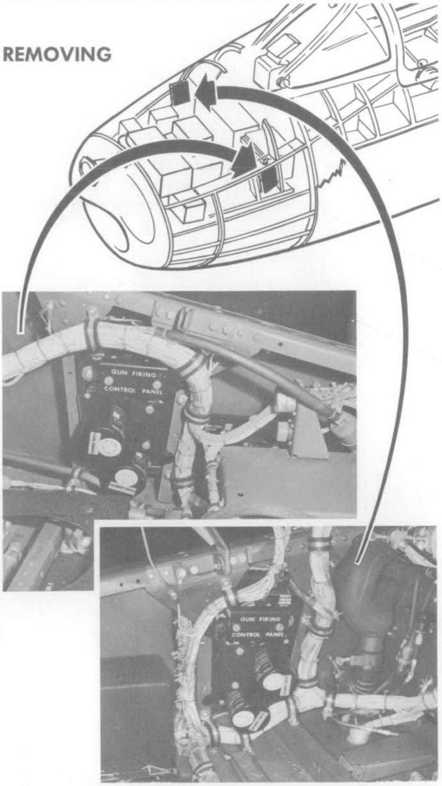
7-30. Four Aero 2A gun firing control units with jumper plugs are installed in the airplane. The firing control units are plug-in units and are mounted by plugging into receptacles on the gun firing control panels. Two gun firing control units are mounted on each of the two gun firing control panels. The Aero 2A gun firing control units transform the 115-volt a-c input power to approximately 250-volt a-c output power. The gun firing control unit relays are energized by 28-volt d-c power when the gun trigger switch is depressed, allowing 250-volt power output to pass from the firing control units to the guns.

Note

Airplanes 139531i through 139555i are factory equipped with Aero 1B fire control units and Aero 2A power supply units. This combination converts 115 volts ac to 300 volts dc and is interchangeable with the Aero 2A fire control units and jumper plugs.

7-31. REMOVING AND INSTALLING GUN FIRING CONTROL UNITS AND JUMPER PLUGS.

REMOVING

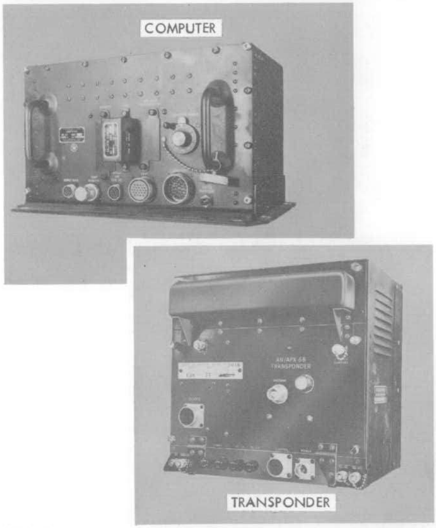


LOCATION OF GUN-FIRING CONTROL PANELS ON AIRPLANES 139531i THROUGH 143542k. (REFER TO INSTALLATION PROCEDURE FOR AIRPLANES 143543l AND SUBSEQUENT.)

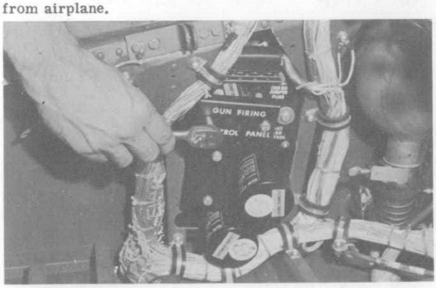
1 Remove electrical power from airplane's electrical system.

Note On airplanes 139531i through 143542k, the units are located in the radio, radar and electrical bay. On airplanes 143543l and subsequent, the units are located behind the electrical equipment access door. To gain access to the units in the radio, radar and electrical bay, it is necessary to remove computer, Mark 86 Mod 0 (paragraph 7-201), and transponder, RT-82A/APX-6. [Refer to Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).]

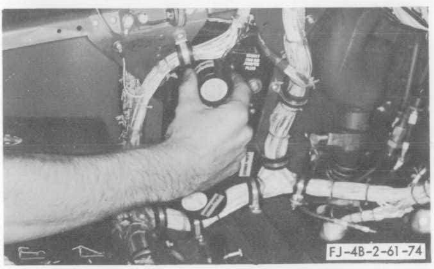
FJ-4B-2-61-73



2 To remove jumper plugs, remove mount bolts from retaining plate and remove plate, bolts and spacers from airplane.

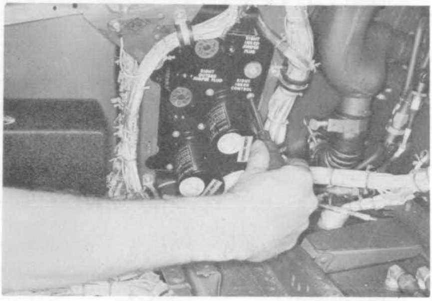


3 Pull jumper plug out of socket in panel and remove from airplane.



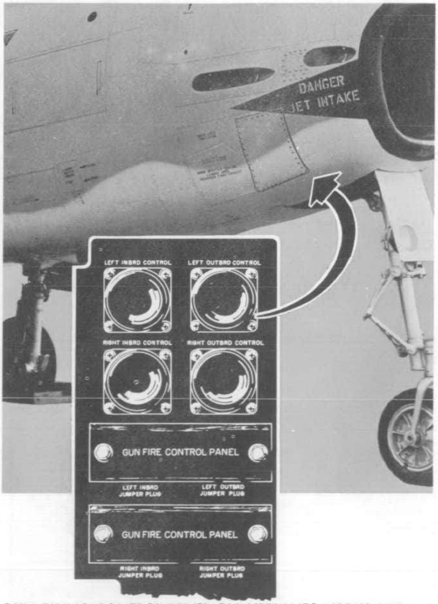
FJ-4B-2-61-74

4 To remove gun-firing control unit, remove retaining screws from flanges at base of unit.



5 Pull gun-firing control unit out of socket in panel and remove from airplane.

INSTALLING



GUN-FIRING CONTROL PANEL ON AIRPLANES 143543l AND SUBSEQUENT. (REFER TO REMOVAL PROCEDURE FOR AIRPLANES 139531i THROUGH 143542k.)

FJ-4B-2-61-93

1 Remove electrical power from airplane's electrical system.

Note On airplanes 139531i through 143542k, the units are located in the radio, radar and electrical bay. On airplanes 143543l and subsequent, the units are located behind the electrical equipment access door. To gain access to the panels in the radio, radar and electrical bay, it is necessary to remove computer, Mark 86 Mod 0 (paragraph 7-201), and transponder, RT-82A/APX-6. [Refer to Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).]

2 To install gun-firing control unit, plug into socket in panel. Make certain that key on center pin aligns with socket keyway.

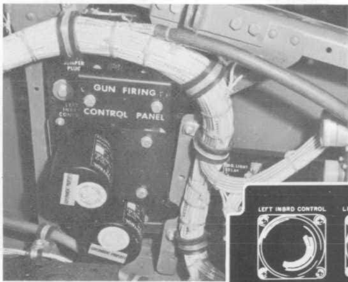
3 Install retaining screws through flanges on control unit.

4 To install jumper plug, plug unit into socket in panel Make certain that key on center pin aligns with socket keyway.

5 Install retaining plate, bolt and spacers over jumper plug.

6 Install units removed for access to gun-firing control panels. (Refer to note above.)

7 Install radio, radar and electrical bay door or electrical equipment access door, depending on location of gun-firing control panel.



AIRPLANES 139531i THROUGH 143542k



AIRPLANES 143543l AND SUBSEQUENT

FJ-4B-2-61-75

7-32. PREOPERATIONAL CHECK OF GUNNERY SYSTEM.

7-33. Perform gunnery preoperational checks as follows:

a. Make certain all armament switches are positioned to "OFF." Remove gun bay access door.

b. Remove protective plugs from gun blast tubes.

c. Check barrel bore, breechblock mechanism and feeder mechanism for excessive dirt, oil or grease. Clean, if necessary, and wipe all excess oil from all moving parts. Install gun muzzle tampions.

d. Inspect belted ammunition for proper loading and feeding.

e. Check buffer and feeder pneumatic quick-disconnects for security of attachment.

f. Open gun charger access door and check pneumatic pressure gage for correct operating pressure.

g. Check air compressor sump oil level.

h. Check feeder tie rods for security of attachment and correct adjustment. Alignment line near aft end of feeder housing flange should be aligned with forward "V" groove alignment line on gun receiver.

i. Check gunnery electrical system for continuity and sufficient insulation. (Refer to paragraphs 7-34 and 7-35.)

j. Install gun bay access door.

7-34. CHECKING GUNNERY ELECTRICAL SYSTEM CONTINUITY AND INSULATION—AIRPLANES 139531i THROUGH 141466j.

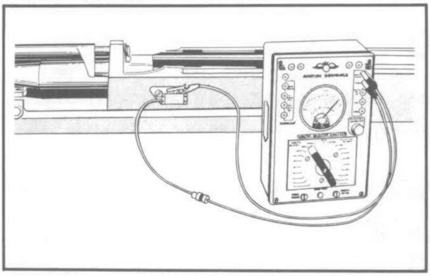
CONTINUITY CHECK

1 Disconnect contact assembly electrical connector from receptacle.

2 Place a shorted cartridge case in chamber and charge breechblock into battery position.

3 Connect one lead of ohmmeter to pin socket "A" in assembly connector and connect other lead to ground.

4 The ohmmeter reading should be less than three ohms. If it is more, check for bad contact or broken contact assembly squib. If ohmmeter reading is zero ohms, check for a short circuit.

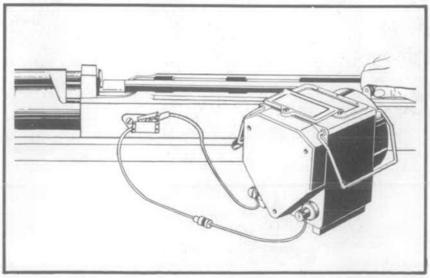


INSULATION BREAKDOWN CHECK

1 Remove shorted cartridge case and replace with an insulated case that has been checked with a megger and has at least one megohm resistance between primer and case.

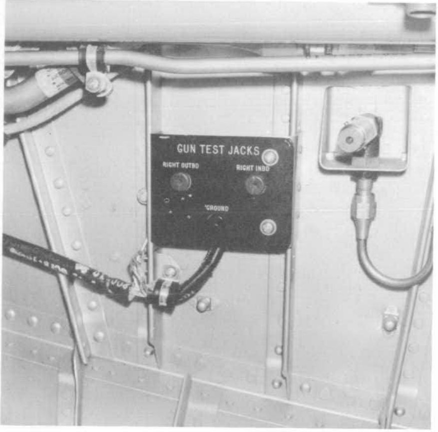
2 Connect one lead of megger to pin socket "A" of the contact assembly connector and ground other lead.

3 A reading of less than one megohm indicates inadequate insulation.



FJ-4B-2-61-76A

7-35. CHECKING GUNNERY ELECTRICAL SYSTEM CONTINUITY AND INSULATION — AIRPLANES 141467j AND SUBSEQUENT.



CONTINUITY CHECK

1 Place a shorted cartridge case in chamber and charge breechblock into battery position.

2 Connect one lead of ohmmeter to "GROUND" jack (black) and connect other lead into outboard or inboard jack (red) to test outboard or inboard gun.

3 The ohmmeter reading should be less than three ohms. If it is more, check for bad contact or broken contact assembly squib. If ohmmeter reading is zero ohms, check for a short circuit.

INSULATION BREAKDOWN CHECK

1 Remove shorted cartridge case and replace with an insulated case that has been checked with a megger and has at least one megohm resistance between primer and case.

2 Connect one lead of megger to "GROUND" jack (black) and connect other lead into outboard or inboard jack (red) to test outboard or inboard gun.

3 A reading of less than one megohm indicates inadequate insulation.

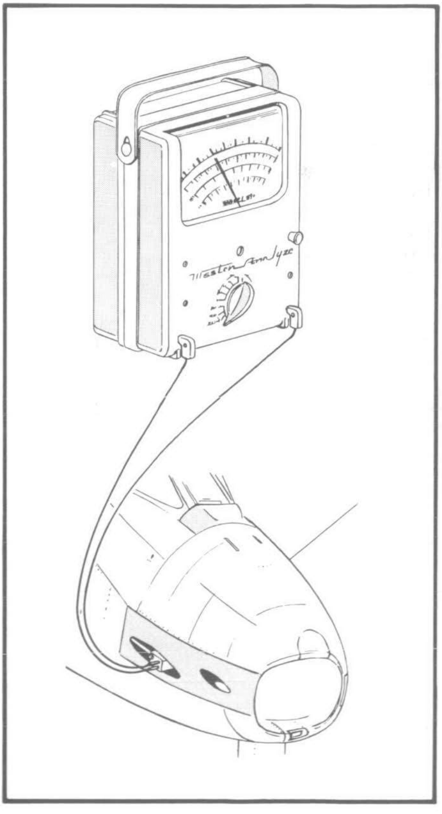
FJ-4B-2-61-19A

7-36. CHECKING GUNNERY ELECTRICAL SYSTEM VOLTAGE—AIRPLANES 139531i THROUGH 141466j.

Warning Prior to checking gunnery electrical system voltage, make certain that ammunition is unloaded and inspect gunnery system to see that no ammunition remains in system.

1 Connect external electrical power to airplane electrical system.

2 Position ARM MASTER switch to "ON" and momentarily depress GROUND FIRING CONTROL switch to energize armament bus.



3 Position gun selector switches to "INBD" and/or "OUTBD" to correspond with gun being checked. Position GUN CONTROL switch to "READY."

FJ-4B-2-61-78

Note When GUN CONTROL switch is positioned to "READY," gun charger will cycle and bolt will move to battery position.

4 Insert gun circuit tester probe through gun barrel until it bottoms on the firing pin and face of bolt assembly.

5 Plug voltmeter pins into respective pin jacks on tester.

6 Depress trigger switch to second detent. Apply pressure on gun circuit tester probe to depress the firing pin approximately 1/16 inch. The voltmeter reading should be 250 volts ac (a-c firing guns).

7 Perform same check on remaining guns, if desired.

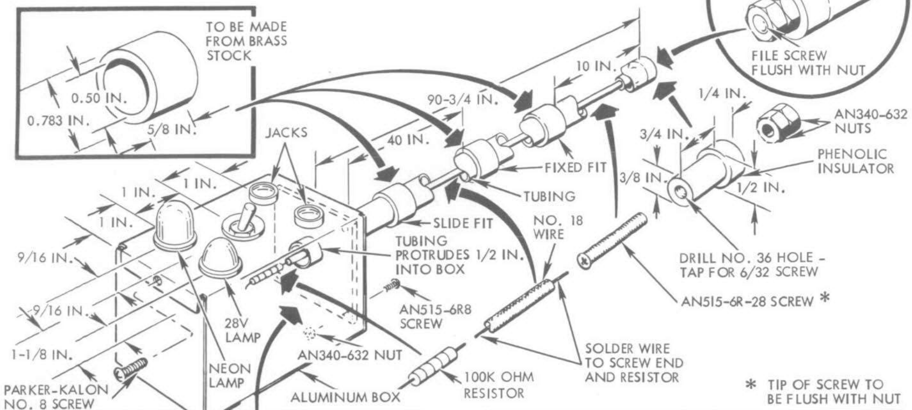
8 Release trigger switch and place ARM MASTER switch to "OFF."

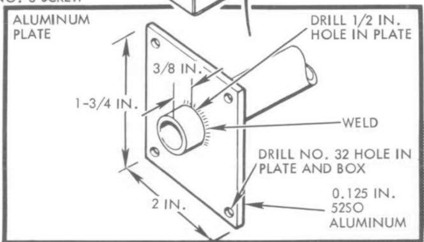
9 Position gun selector switches to "OFF" and position GUN CONTROL switch to "SAFE."

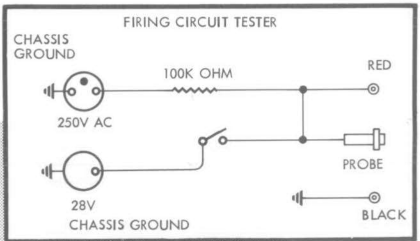
10 Disconnect voltmeter and remove gun circuit tester from gun barrel.

11 Remove external electrical power from airplane electrical system.

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QUANITY	DESCRIPTION
1	ALUMINUM BOX, 2-1/4 x 2-1/4 x 4 IN.
1	RESISTOR, 100K OHM, 1 WATT
1	RED JACK
1	BLACK JACK
1	BAYONET SOCKET (217H)
1	NEON LAMP, 105 - 125V, 1/4 WATT (NE-51)
1	LAMP 28V & LAMP ASSY (AN313)
8 FT	ALUMINUM TUBING, 0.500 x 0.065 IN.
1 PC	ALUMINUM PLATE, 2 x 1-3/4 x 1/8 IN.

QUANTITY	DESCRIPTION
8 FT	NO. 18 WIRE
1	SCREW (AN515-6R-28)
1	PHENOLIC INSULATOR
3	BRASS SPACERS
4	SCREW (AN515-6R8)
6	NUTS (AN340-632)
1	PARKER-KALON NO. 8 SCREW
1	SWITCH (AN3021-3)

FJ-4B-2-61-18A

Figure No. 7-8. Gun Circuit Tester Probe

7-36A. CHECKING GUNNERY ELECTRICAL SYSTEM VOLTAGE—AIRPLANES 141467j AND SUBSEQUENT.

Warning Prior to checking gunnery electrical system voltage, make certain that ammunition is unloaded and inspect gunnery system to see that no ammunition remains in system.

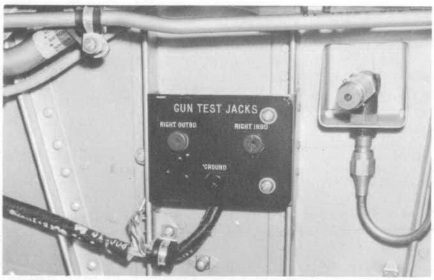
1 Connect external electrical power to airplane electrical system.

2 Position ARM MASTER switch to "ON" and momentarily depress GROUND FIRING CONTROL switch to energize armament bus.

3 Position gun selector switches to "INBD" and/or "OUTBD" to correspond with gun being checked. Position GUN CONTROL switch to "READY."

Note When GUN CONTROL switch is positioned to "READY," gun charger will cycle and bolt will move to battery position.

4 Plug voltmeter pins into test panel.



5 Depress trigger switch to second detent. The voltmeter reading should be 250 volts ac (a-c firing guns).

6 Perform same check on remaining guns if desired.

7 Place a shorted cartridge case in chamber and disconnect electrical connector at top of gun bay.

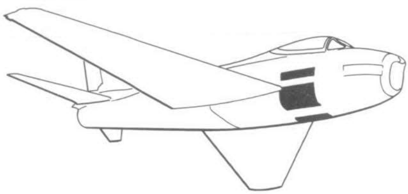
8 Perform ohmmeter check from pin "A" of electrical disconnect through the gun to ground. A reading of other than zero ohms indicates an open circuit between the gun electrical disconnect and ground.

9 Replace the shorted cartridge case with an insulated cartridge case.

10 Perform ohmmeter check from pin "A" of electrical disconnect through the gun to ground. A reading of other than infinite ohms indicates a shorted circuit.

FJ-4B-2-61-97

7-37. LOADING GUNNERY SYSTEM.



1 Remove electrical power from airplane electrical system.

Caution Make certain that all armament switches are positioned to "OFF."

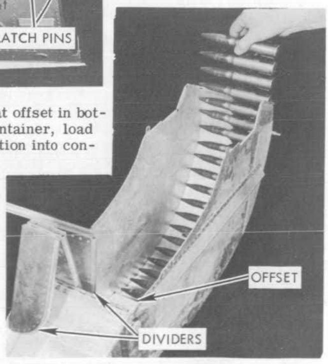


2 Remove gun bay door and open ammunition compartment door. Check to make certain no ammunition is present in guns or feeders.



3 Release ammunition container latch pins and remove containers from airplane. Open container covers and raise dividers.

4 Starting at offset in bottom of container, load belted ammunition into container.

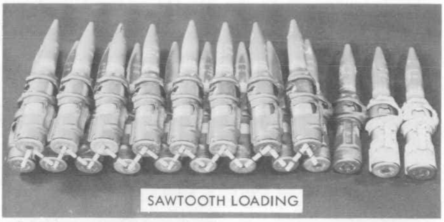


Note In loading left-hand guns, the leading link of the belt must be a double link and trailing link a standard link. In loading right-hand guns, leading link must be a standard link and trailing link a double link.

FJ-4B-2-61-80

5 Lay two complete rows of ammunition in container and drop hinged divider on ammunition. Lay two complete rows of ammunition on top of first divider and drop second divider.

6 Load top two rows of ammunition in sawtooth fashion since space will not permit rounds to lie directly on top of each other.



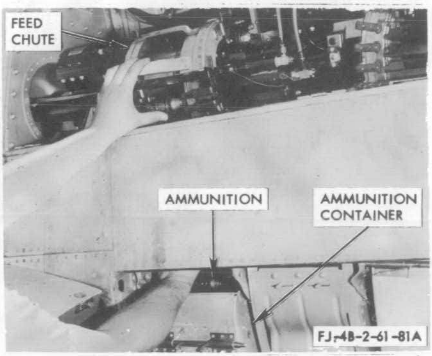
Note Nominal load for ammunition container is 125 rounds. Overload capacity of container is 144 rounds.

7 Hoist loaded ammunition container to loading position and slide into ammunition bay. Leave sufficient space to reach into container.

Note Make certain that ammunition container handles are in inboard position before sliding into ammunition bay.

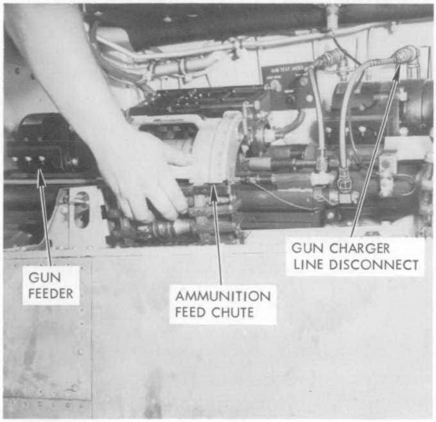
8 Feed ammunition up through ammunition booster and into gun bay.

Note Make certain that body of links faces outboard and correct leading link is installed.



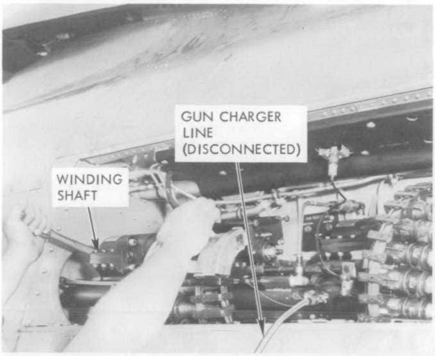
FJ-4B-2-61-81A

9 Pull ammunition up through ammunition feed chute until leading round is against feeder star wheels.



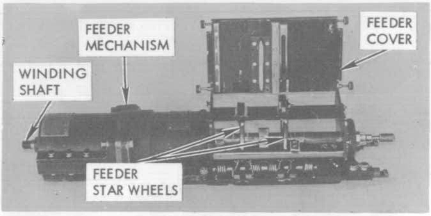
10 Disconnect gun charger pneumatic line at disconnect in gun bay. This will allow the gun bolt to come forward into battery position.

11 Make certain gun bolt is in battery position. Push ammunition into feeder while turning feeder spring winding shaft at aft end of feeder. Winding shaft may be turned with a feeder winding wrench or with a 1/2-inch open-end wrench.



Warning Use heel of hand to push ammunition into feeder. Do not insert fingers between rounds.

FJ-4B-2-61-82A



13 Continue to wind feeder driving spring after star wheels have engaged ammunition belt and leading round is on top of the bolt until driving spring is fully wound. Do not attempt to wind further.

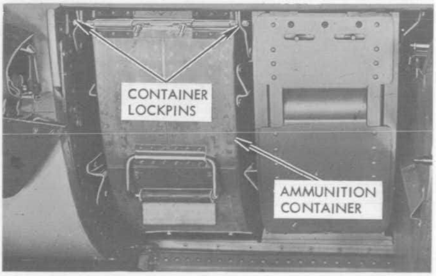
14 When feeder driving spring is fully wound, reconnect gun charger pneumatic line at disconnect. The gun bolt will then move to retracted position and the feeder driving spring will force the leading round into bolt pickup position.

Warning Do not disconnect charger line again. Disconnecting charger line again will bring gun bolt into battery and chamber leading round. Subsequent efforts to resume normal operation may result in a double charge and round explosion.

Note Never wind feeder mechanism driving spring with bolt in retracted position or with a round in the chamber.

15 Gun is now in safe condition. When ready to fire, positioning GUN CONTROL switch to "READY" will bring bolt into battery, chambering the leading round. Feeder drive spring wind has decreased approximately one-fourth turn from fully wound, the correct condition for firing.

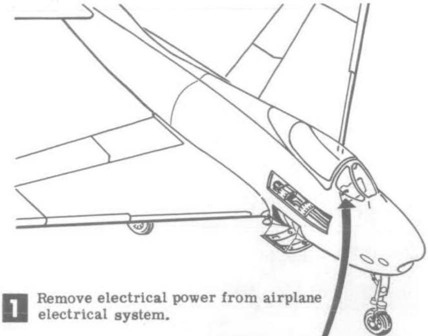
16 Raise ammunition container and engage container lockpins. Make certain lockpin latches are engaged in locking detents.



17 Close ammunition bay access door and install gun bay access door.

FJ-4B-2-61-83

7-38. UNLOADING GUNNERY SYSTEM.



1 Remove electrical power from airplane electrical system.

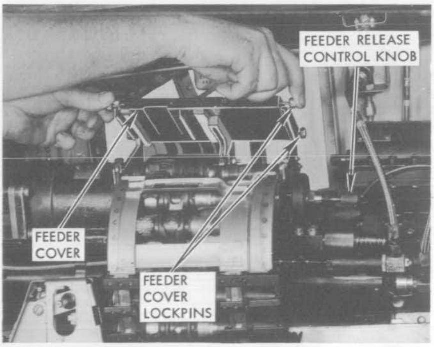
Caution Make certain all armament switches are positioned to "OFF."



2 Remove gun bay door and open ammunition compartment door. Release ammunition container lockpins.

Caution Check to make certain gun bolts are retracted and chambers are empty.

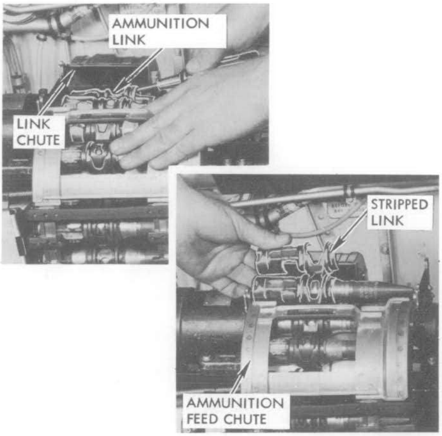
3 Depress feeder release control knob at forward end of feeder to release drive spring torque.



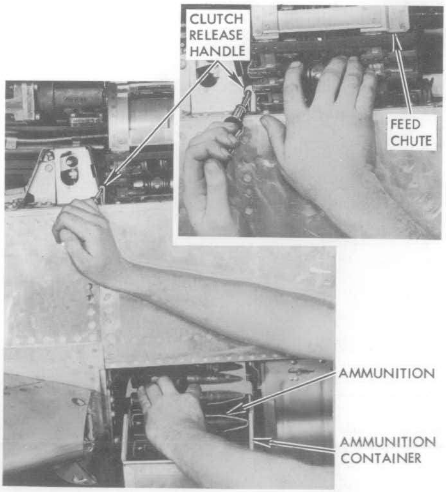
4 Remove feeder cover from feeder.

FJ-4B-2-61-84

5 The link engaged with the stripping finger will be partially stripped from the round. Complete stripping the link from the round manually, thereby breaking the ammunition belt.



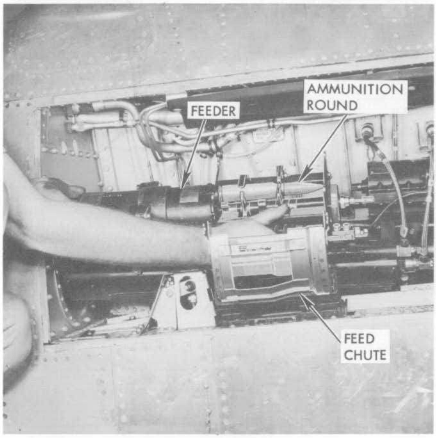
6 Release ammunition boost unit star wheels by pulling up clutch release handle at left side of boost unit mouth.



7 While holding clutch release handle up, pull down on belted ammunition and strip ammunition free of boost unit star wheels.

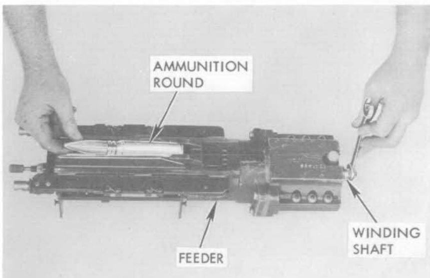
FJ-4B-2-61-85

8 **Disengage feed and link chutes from feeder throat and remove feeder from gun. (Refer to paragraph 7-23.)** The ammunition rounds not removed with the belt will be contained in feeder.



9 After removing feeder, inspect gun to make certain that gun bolt is in retracted position and no ammunition remains in gun.

10 Remove rounds remaining in feeder by turning drive spring winding shaft and removing rounds as starwheels bring rounds to bottom of feeder.



11 Reinstall feeder on gun. (Refer to paragraph 7-23.)

12 Remove ammunition containers from airplane and unload ammunition.

13 Replace ammunition containers in airplane and close ammunition compartment doors. Install gun bay doors.

FJ-4B-2-61-86

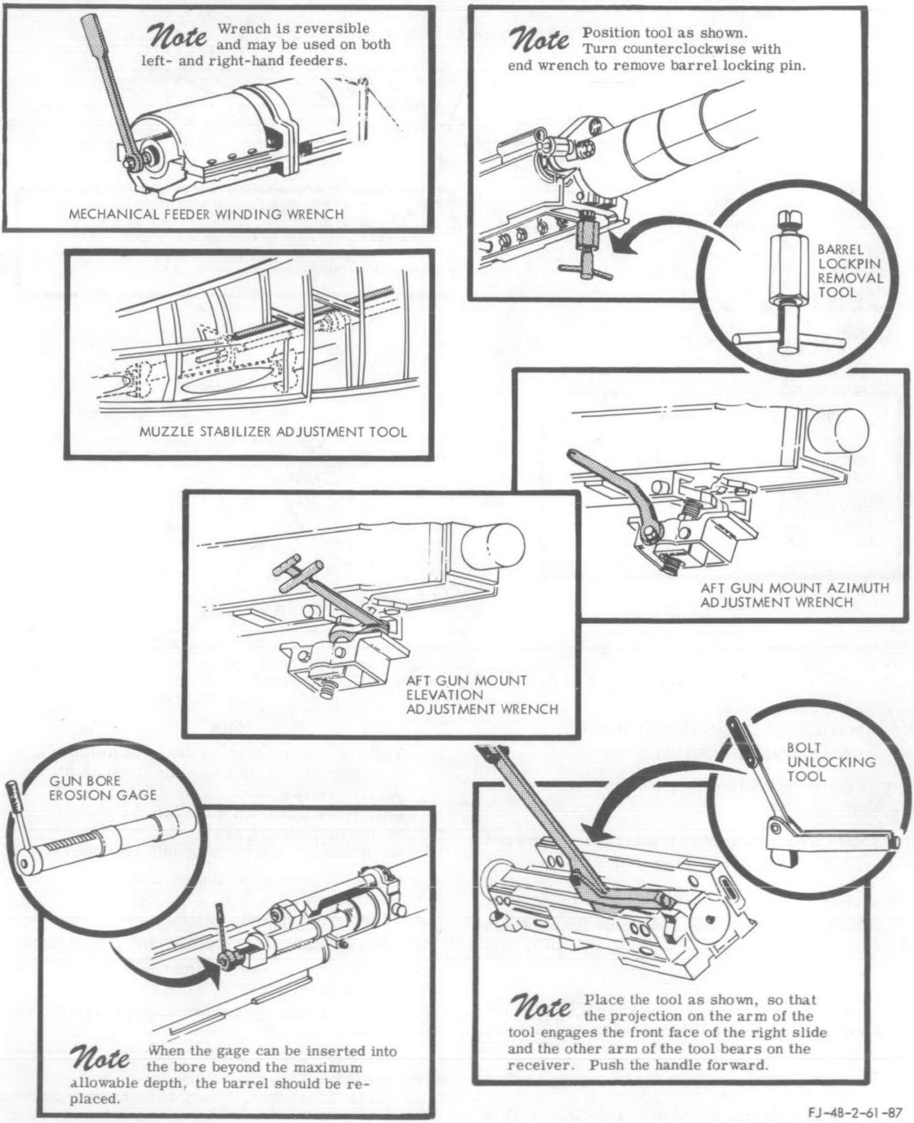


Figure No. 7-9. Gunnery System Special Tools (Sheet 1)

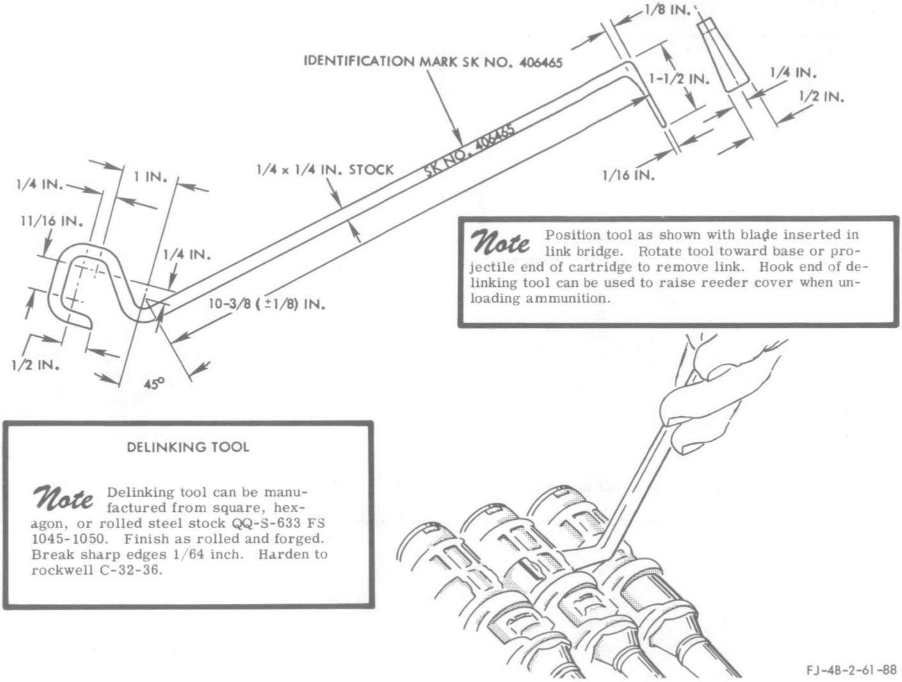


Figure No. 7-9. Gunnery System Special Tools (Sheet 2)

7-39. POST-OPERATIONAL CHECK OF GUNNERY SYSTEM.

7-40. Perform gunnery post-operational checks as follows:

a. Make certain all armament switches are positioned to "OFF." Remove gun bay access door.

b. Unload ammunition. (Refer to paragraph 7-38.)

c. Clean all gun parts and components that have been exposed to powder gases. Dry and lubricate with a light coat of oil (item 88, materials list).

d. Clean all parts of the feeder subjected to powder gases and lubricate with a light coat of grease (item 82, materials list).

e. Install protective plugs in gun blast tubes.

f. Open gun charger access door and check level of oil in pneumatic compressor sump.

Note

The gun bore and chamber should be inspected at regular intervals to determine extent of erosion. To check erosion, insert a barrel erosion gage in the gun chamber. When the gage can be inserted beyond the maximum allowable depth reading, the barrel should be replaced.

g. Install gun bay access door.

7-41. GROUND FIRING GUNS.

7-42. Use the following procedure for ground firing:

a. Position the airplane in front of a suitable backstop or target area.

b. Remove gun bay access door and open ammunition access door.

c. Bore sight guns to make certain they are aligned with target area.

d. Check barrel bore, breechblock, receiver mechanism and feeder mechanism for proper lubrication and cleanliness. Chamber and bore must be free of oil.

e. Open gun charger access door and check pneumatic system pressure gage for correct operating pressure. Check oil level in pneumatic compressor sump.

f. Check buffer and charger pneumatic lines for security of attachment.

g. Load ammunition.

CAUTION

Do not load ammunition until all checks and adjustments have been made. Do not allow personnel to pass in front of airplane after ammunition is loaded.

h. With ARM MASTER switch positioned to "ON," momentarily actuate ground firing control switch on test switch panel to obtain electrical power on armament bus. Position GUN SELECTOR switches to "INBD" and/or "OUTBD" and place GUN CONTROL switch to "READY."

i. Follow standard air firing procedure to fire guns.

WARNING

Gun bay access doors and ammunition bay access doors must be open to prevent accumulation of explosive powder gases.

j. If a misfire occurs during ground firing, wait 30 seconds from time of misfire and recharge guns, thereby ejecting misfired round. Immerse misfired round in water and immediately remove from vicinity of personnel and equipment.

Note

Any stoppage will be considered a misfire when bolt is in battery with a round in the chamber.

CAUTION

If gun is hot and round cannot be removed, the bolt should be closed and kept in battery position until the hand can be placed on barrel comfortably. The probability of discharge of a round by a hot barrel increases with length of time round remains in chamber. The safest time within which a misfire may be removed from chamber is 30 to 45 seconds after stoppage of gun.

k. After ground firing is completed, immediately clear all guns of ammunition.

l. Position armament control switches to their respective "OFF" positions and remove electrical power from airplane.

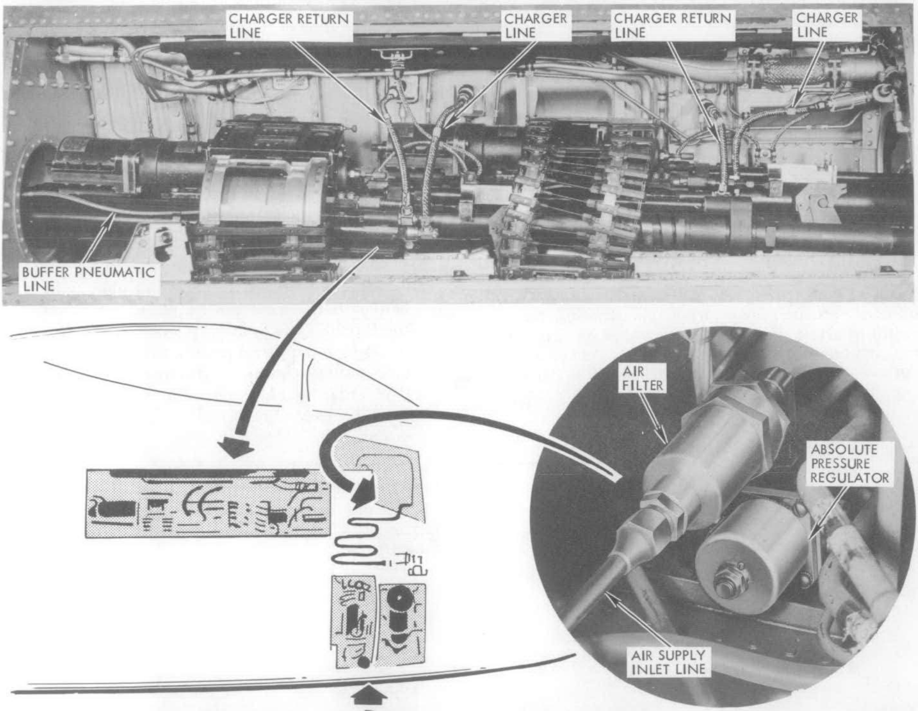


Figure No. 7-10. Pneumatic System Unit Location

PNEUMATIC SYSTEM

7-43. PNEUMATIC SYSTEM.

7-44. The pneumatic system (figure 7-10) is a 1500 psi, constant pressure-type system designed to provide the gun chargers and buffers with a clean, dry source of compressed air. An electric motor-driven compressor is the pneumatic power source after the system has been initially charged by ground equipment. The compressor has an operating pressure range between 1050 psi minimum and 1650 psi maximum and is controlled by an integral pressure switch on the compressor motor. An air filter and an absolute pressure regulator supply the compressor inlet with supercharged air to prevent the compressor from cavitating at altitude. A normally open, solenoid-operated dump valve is energized and de-energized simultaneously with the compressor motor to dump compressed air in the pneumatic pressure lines overboard upon completion of compressor operation. Moisture removing equipment consisting of a mechanical moisture separator, a chemical drier and a back-pressure valve aids in drying the compressed air before it is stored in the 200-cubic inch air storage bottle. An air filter, installed in the pneumatic pressure line, filters the air enroute to the gun chargers and gun buffers. A pressure relief valve set to crack at 1750 psi protects the pneumatic system against excessive pressure in the event of thermal expansion or pressure switch malfunction. The normally open, solenoid-operated charging valve directs air pressure to the gun charger units. A ground filler fitting and a shuttle valve are provided to initially charge the pneumatic system to operating pressure, using ground equipment. Pneumatic system pressure is indicated by a direct reading pressure gage.

7-45. FUNCTION OF PNEUMATIC SYSTEM.

7-46. With the airplane engine operating, the compressor inlet line is supercharged to 140 psi by supply air from the windshield defrost line. The supply air is passed through a 10-micron filter and is regulated from 140 psi down to 15 psi by means of an absolute pressure regulator before reaching the compressor inlet port. If air pressure in the pneumatic system is reduced to a minimum of 1050 psi when electrical power is on the airplane and the air compressor circuit breaker (AIR COMP) is engaged, the pressure switch closes the circuit to the compressor motor, starting the electric motor-driven compressor and closing the normally open dump valve. The three-stage compressor maintains pressure and flow (0.45 cfm at 1500 psi) to the pneumatic system. The compressed air passes through the mechanical moisture separator, the chemical drier and the back-pressure valve where moisture is removed before the compressed air is delivered to the air storage bottle. Compressed air from the storage bottle is passed through a 25-micron air filter and a pressure relief valve to the gun charging valve, gun chargers and gun buffers. Pneumatic system pressure is applied constantly to the gun buffers and to the rear side of the gun charger piston. Air pressure is routed through the normally open gun charging valve to the forward side of the gun charger piston. Due to the larger piston area on the forward side of the charger piston, the charger will hold the gun bolt in the retracted position. Energizing the gun charging valve vents downstream air to the atmosphere and permits air pressure behind the charger piston to bring the gun bolt into battery position. The gun charging valve may be energized electrically through the gun control switch (GUN CONTROL) or manually by depressing the override button on the valve body. When air pressure in the pneumatic system approaches 1525 psi (1650 psi maximum), the pressure switch opens the circuit to the electric motor-driven compressor. Simultaneously, the circuit to the normally open dump valve is broken and the compressed air in the pneumatic pressure line is vented to the atmosphere to remove moisture accumulated during compressor operation. The check valve downstream of the back-pressure valve prevents system pressure in the air storage bottle from escaping through the normally open dump valve.

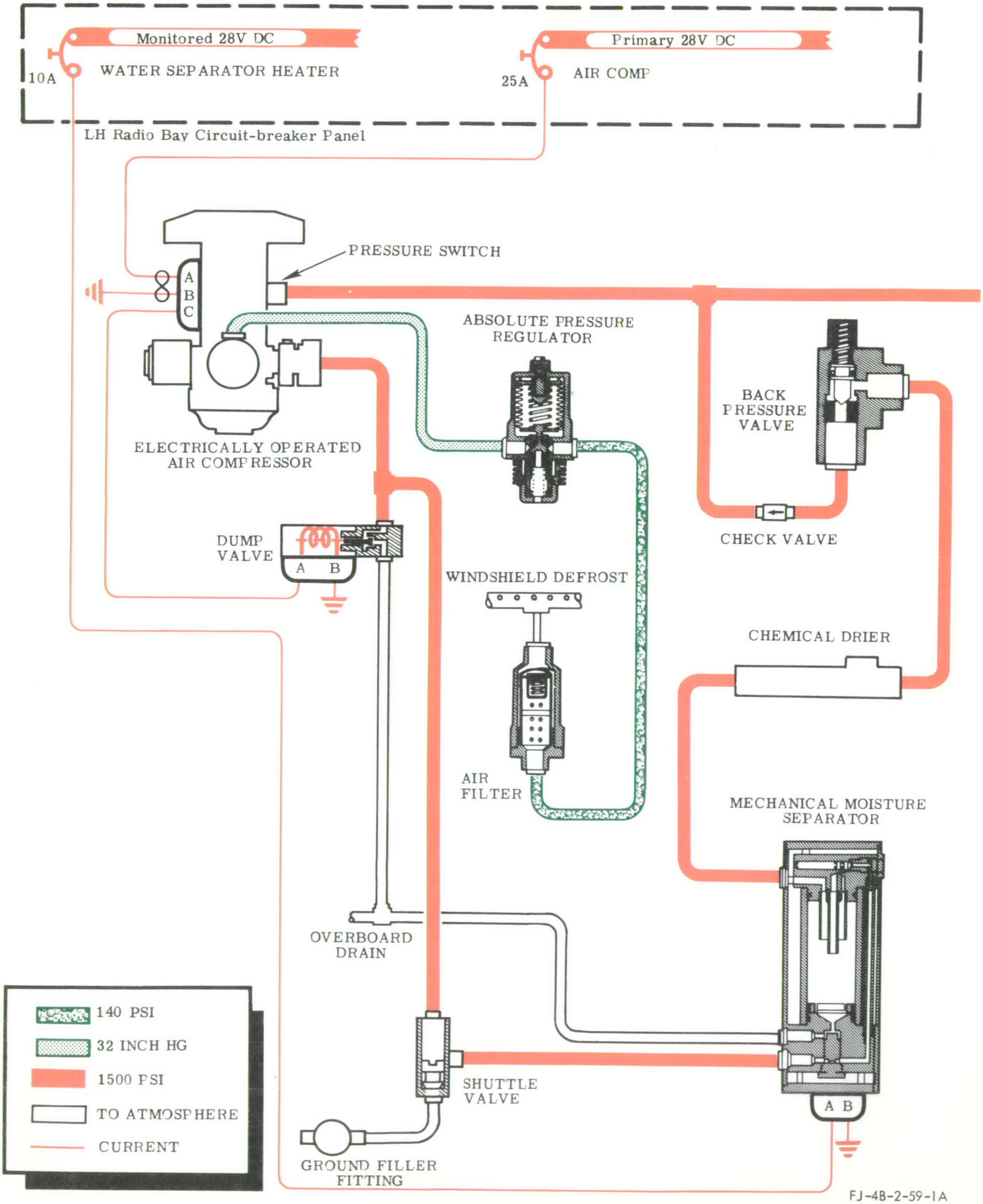


Figure No. 7-11. Pneumatic System—Compressor Operating, Gun Charging Valve Energized (Sheet 1)

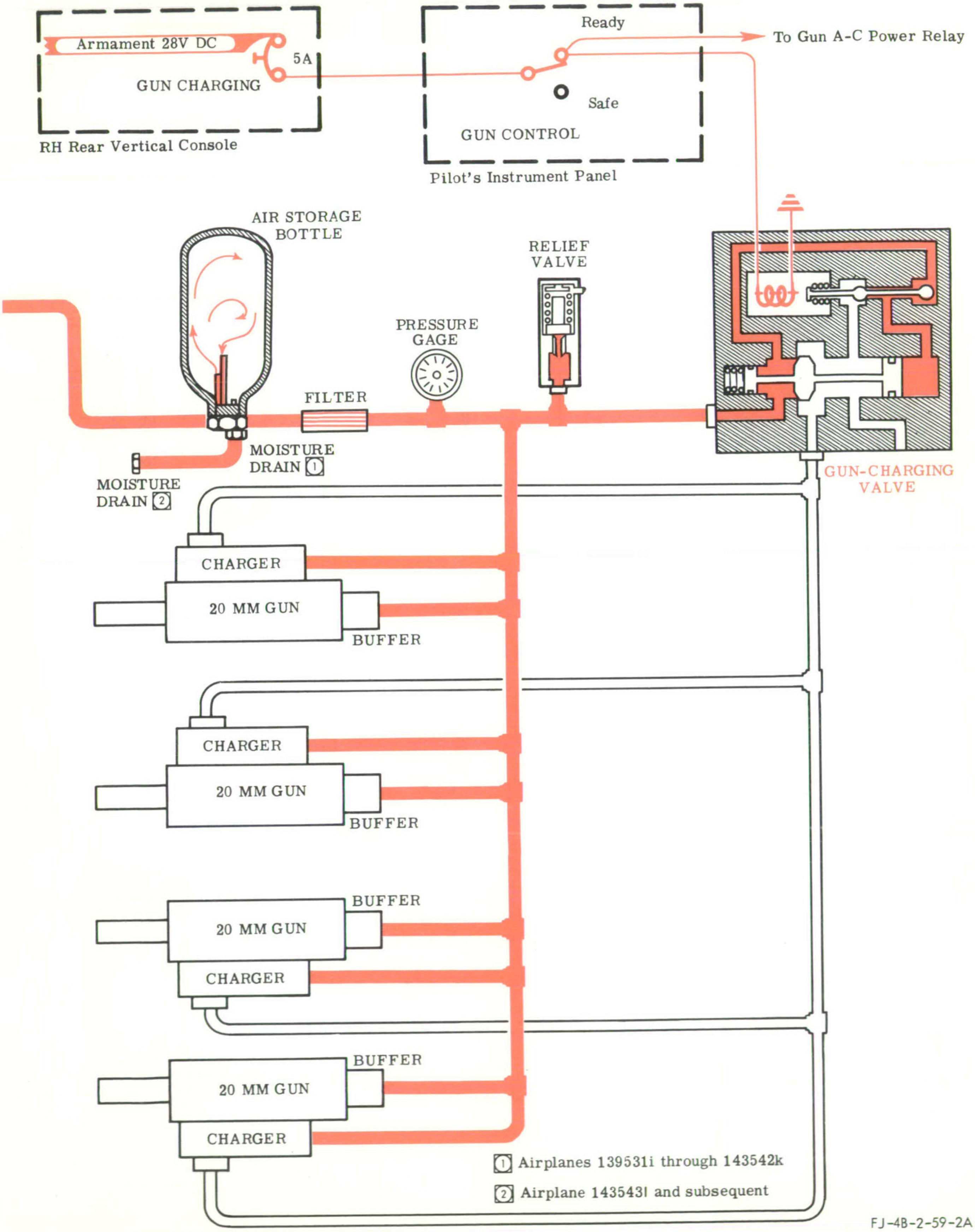


Figure No. 7-11. Pneumatic System—Compressor Operating, Gun Charging Valve Energized (Sheet 2)

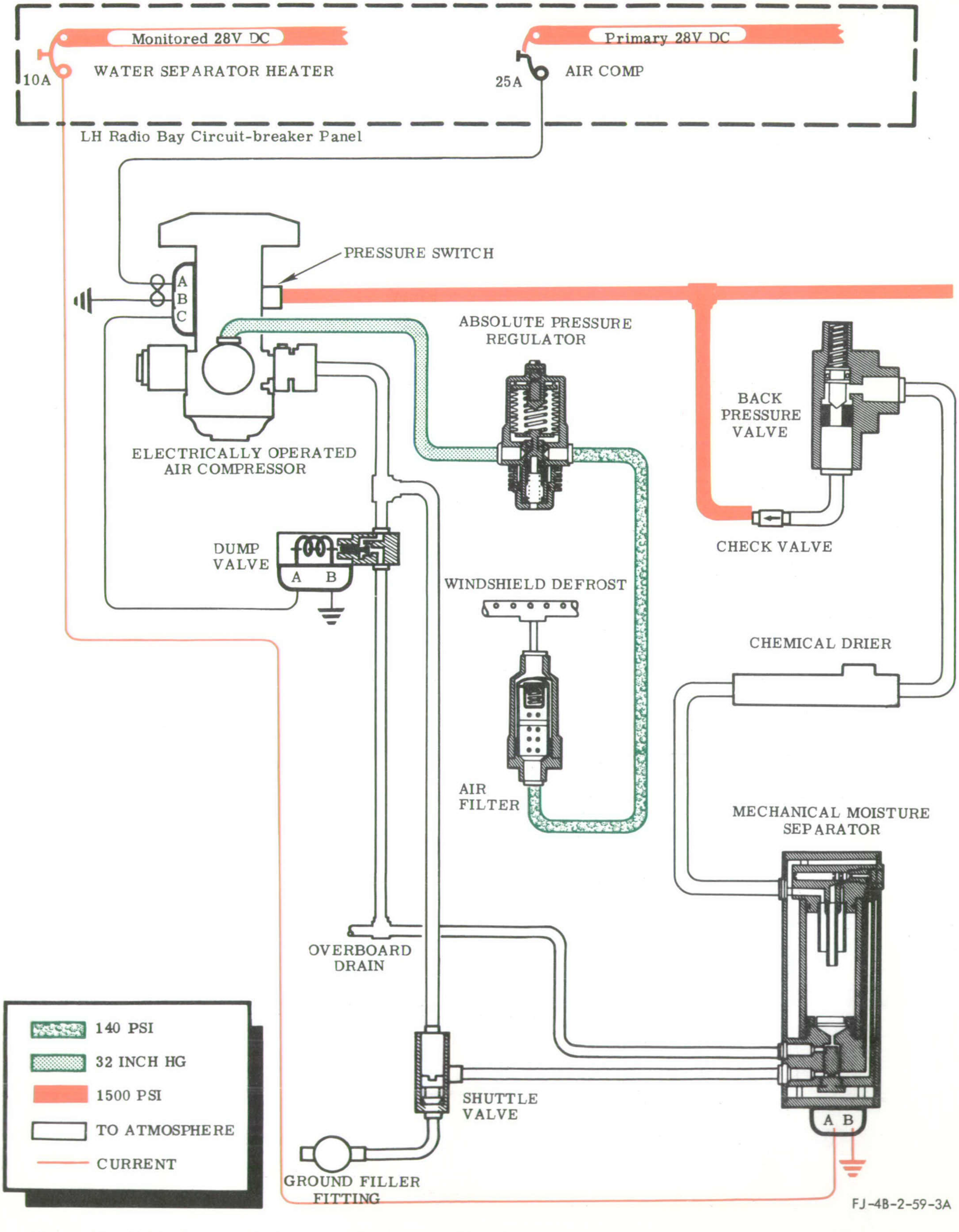


Figure No. 7-12. Pneumatic System—Compressor Not Operating, Gun Charging Valve De-energized (Sheet 1)

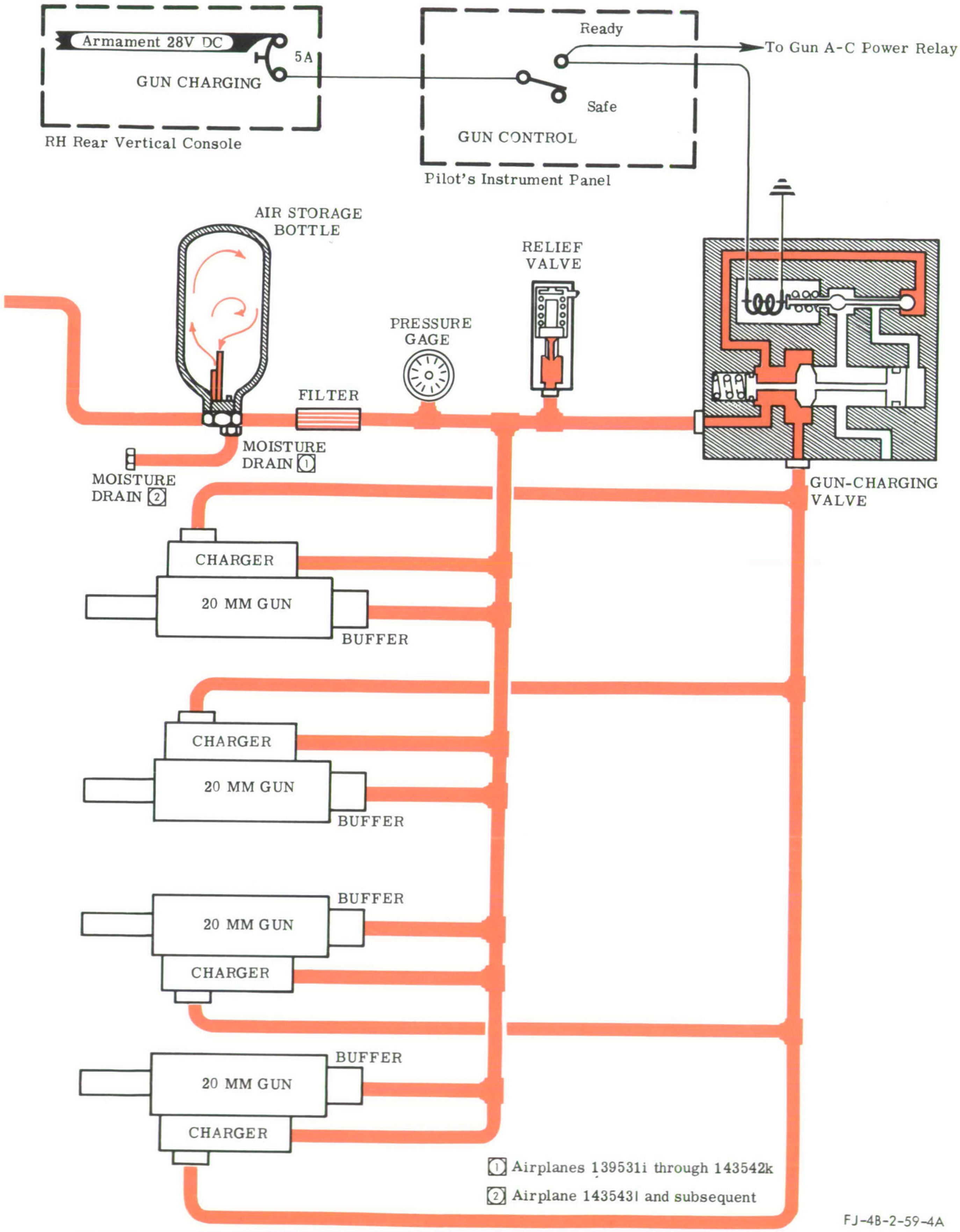


Figure No. 7-12. Pneumatic System—Compressor Not Operating, Gun Charging Valve De-energized (Sheet 2)

7-47. TROUBLE SHOOTING PNEUMATIC SYSTEM.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: 28-volt d-c electrical power applied to airplane.
AIR COMP and WATER SEPARATOR HEATER circuit breakers engaged.
GUN CONTROL switch positioned to "SAFE."
Pneumatic pressure in system below 1050 psi.
Ammunition removed from gunnery system.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
AIR COMPRESSOR WILL NOT OPERATE.			
Defective compressor and/or wiring components.	Check between test point APA and ground.	28 volts dc.	Replace defective compressor.
		Zero volts.	Replace defective power wire segment.
AIR COMPRESSOR WILL NOT SHUT OFF WHEN 1650 PSI IS OBTAINED.			
Defective pressure switch in pneumatic compressor.	Check between test point APB and ground.	Zero volts.	No action.
		28 volts dc.	Replace defective compressor.
MECHANICAL MOISTURE SEPARATOR FAILS TO DUMP OVERBOARD AFTER COMPRESSOR OPERATION IS COMPLETE.			
Dump valve defective.	Check between test point APC and ground.	Zero volts.	Replace defective dump valve.
		28 volts dc.	Replace defective compressor.
EXCESSIVE MOISTURE COLLECTING IN AIR STORAGE BOTTLE.			
Mechanical moisture separator heater not operating electrically.	Check between test point APD and ground.	28 volts dc.	Replace defective mechanical moisture separator.
		Zero volts.	Replace defective power wire segment.
ELECTRICAL POWER FAILURE.			
Defective circuit breaker.	Check between test point PGD or PGP and ground.	28 volts dc.	Replace defective circuit breaker.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
AIR COMPRESSOR OPERATES CONTINUOUSLY AND A MAXIMUM OF 1650 PSI CANNOT BE OBTAINED IN THE PNEUMATIC SYSTEM.			
Excessive system leakage.	Inspect pneumatic system for leakage. (Refer to paragraph 7-48.)		Perform necessary maintenance to stop leakage.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
GUNS FAIL TO CHARGE WHEN GUN CONTROL SWITCH IS POSITIONED TO "READY."			
Gun charging valve not operating electrically due to one or a combination of the following:	**WARNING** Disengage BOMB & GUN TRIGGER circuit breaker and make certain that no ammunition remains in the gunnery system.		
a. Defective charging valve.	Check between test point ACA and ground.	28 volts dc.	Replace defective charging valve.
		Zero volts.	Continue trouble shooting.
b. Defective control switch or circuit wiring.	Check between test point ACB and ground.	28 volts dc.	Perform wire segment continuity check and replace defective wire to charging valve.
		Zero volts.	Replace defective GUN CONTROL switch or replace defective power wire.
ELECTRICAL POWER FAILURE.			
Defective circuit breaker.	Check between test point PCE and ground.	28 volts dc.	Replace defective circuit breaker.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
GUN BOLT REMAINS IN BATTERY WHEN ELECTRICAL POWER IS REMOVED FROM SYSTEM.			
Defective gun charging valve.	With electrical power on armament bus and pneumatic system charged to 1500 psi, move GUN CONTROL switch between "SAFE" and "READY" several times. Gun bolt should cycle. **WARNING** Make certain all ammunition is removed from gunnery system before attempting to cycle gun bolt.		Replace defective gun charging valve.
Defective gun components.			Refer to paragraph 7-7, Trouble Shooting Gunnery System.

7-48. CHECKING PNEUMATIC SYSTEM.

7-49. An operational check of the pneumatic system must be performed periodically or after accomplishment of maintenance work that involves removal of any part or unit of the system.

WARNING

Extreme safety precautions must be observed during this check-out. Inspect the gunnery system prior to performing the check-out to make certain all ammunition has been removed.

a. Drain pneumatic system by opening the moisture drain plug. (See figures 7-13 and 7-13A.)

WARNING

Do not attempt to drain system pressure by loosening pneumatic fittings.

b. Connect external 28-volt d-c power to the airplane's electrical system.

c. Engage AIR COMP circuit breaker and check compressor operation.

CAUTION

Check level of compressor lubricating oil before operating compressor. Fluid level should be near lower step in sump. Use lubricating oil (item 86, materials list).

After compressor has been operated satisfactorily, stop compressor and close moisture drain plug.

d. Using a charged bottle of dried air or nitrogen, connect bottle to ground pneumatic filler valve and gradually charge pneumatic system to 400 psi pressure. The pneumatic system pressure gage is located adjacent to the air compressor. At 400 psi pressure, check system for leaks. Large leaks may be detected by a shrill whistle.

e. Depressurize system and correct leaks.

WARNING

Never attempt to correct leakage or torque fittings with system pressurized. Always bleed system first.

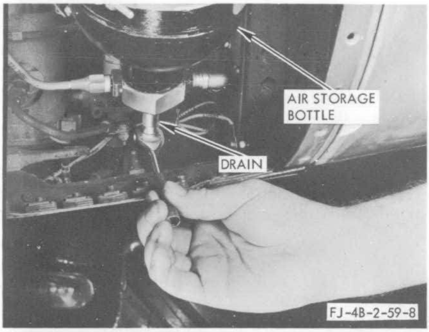


Figure No. 7-13. Draining Air Storage Bottle—Airplanes 139531i through 143542k

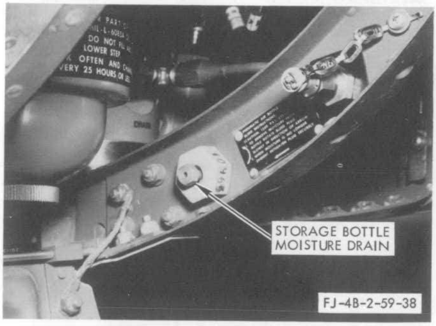


Figure No. 7-13A. Draining Air Storage Bottle—Airplanes 143543l and Subsequent

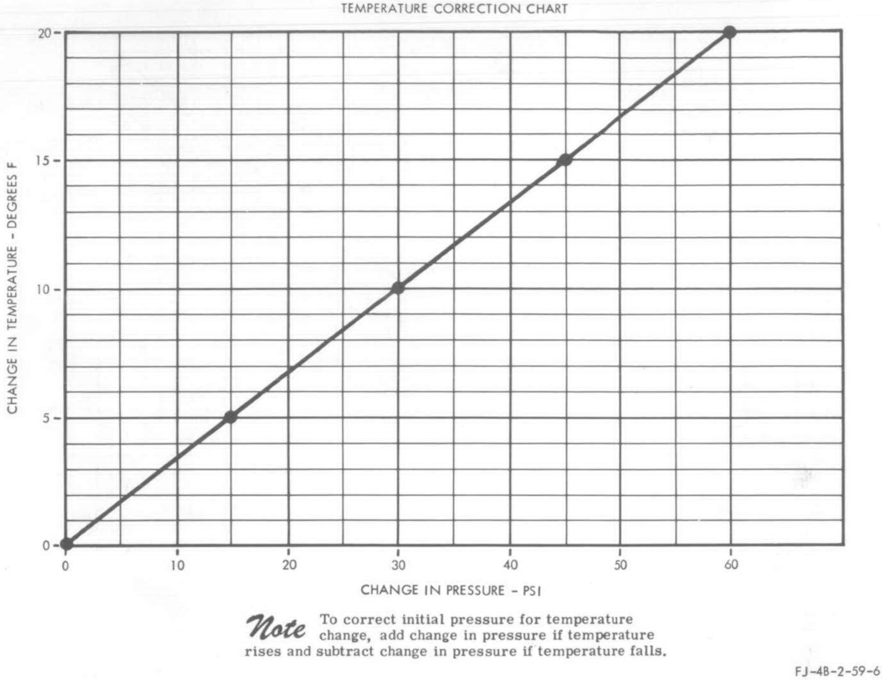


Figure No. 7-14. Pneumatic System Temperature Correction Chart

f. Charge pneumatic system to 1000 psi pressure from the ground equipment. Engage AIR COMP circuit breaker and allow compressor to operate until pressure switch opens circuit and stops compressor. Air compressor should increase system pressure from 1000 to 1500 psi in approximately 10 minutes.

g. At a system pressure of 1525 psi (1650 psi maximum), the pressure switch should open the electrical circuit to the air compressor and stop the compressor. When the compressor stops, the overboard dump valve should also be de-energized, dumping the air contained in the pneumatic pressure lines. When the line pressure drops to approximately 900 psi, the check valve in the mechanical moisture separator closes and the remainder of the air pressure forces the moisture separator shuttle valve open and blows the moisture collected in the separator to the atmosphere. There should be no flow through the overboard dump valve or the moisture separator shuttle valve while the compressor is in operation.

h. Allow one-half hour for stabilization and then record the gage pressure and the temperature. Temperature may be obtained by taping a thermometer directly to the air storage bottle. After a time lapse of one hour, record the final gage pressure and temperature. Correct initial pressure reading for temperature change. (See figure 7-14.) Determine pressure drop by subtracting the final reading from the corrected initial reading. Compare pressure loss with pneumatic system leakage chart and determine whether or not leakage is within tolerance. (See figure 7-15.)

i. If leakage exceeds allowable limits, check system for leaks by applying a solution of Castile soap (item 115, materials list) with a clean brush. After checking, all parts of the system should be cleaned with water and dried.

j. With pneumatic system pressurized to 1500 psi pressure and AIR COMP circuit breaker engaged, bleed air pressure from the system through the air storage bottle drain and observe the system pressure gage. At a minimum of 1050 psi pressure, the pressure switch should close the circuit to the penumatic compressor motor. At a maximum system pressure of 1650 psi, the

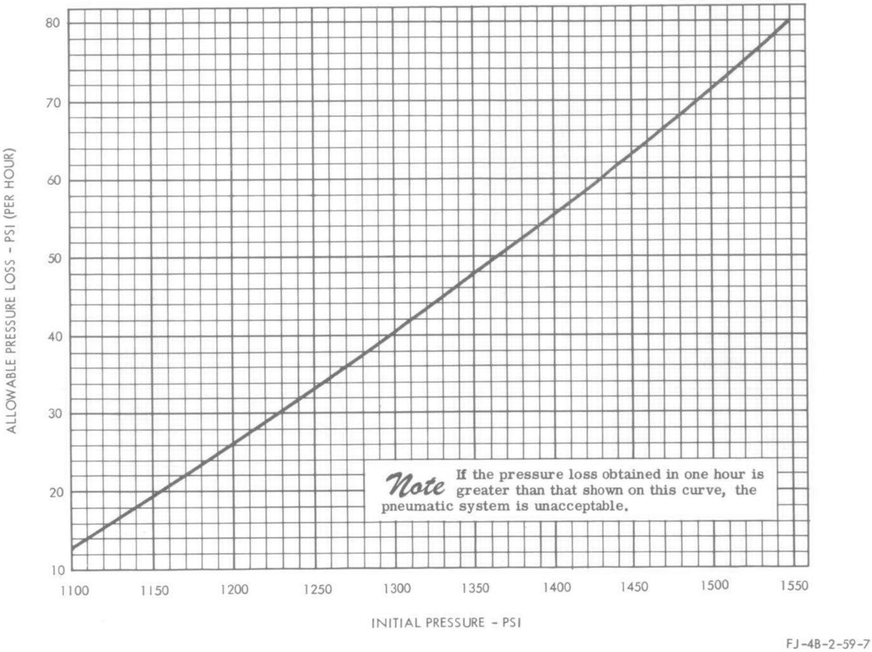


Figure No. 7-15. Pneumatic System Allowable Leakage Chart

pressure switch should open the circuit to the compressor motor.

k. With electrical power on the airplane's armament bus and the pneumatic system pressurized to 1500 psi, position ARM MASTER switch to "ON." Move the GUN CONTROL switch to "READY" position to operate the gun charging valve. Move the GUN CONTROL switch to "SAFE" and back to "READY" several times and observe charging valve operation.

WARNING

Make certain all ammunition is removed from guns before checking charging valve operation. As an additional precaution, disconnect gun synchronizer switch electrical plugs from receptacles in top of gun bays.

l. Position GUN CONTROL switch to "SAFE" and ARM MASTER switch to "OFF." Remove external power from airplane's electrical system. Connect gun synchronizer electrical plugs and safety-wire.

7-50. AIR COMPRESSOR SUPPLY SYSTEM.

7-51. The air compressor supply system is composed of an absolute pressure regulator, a 10-micron air filter and related plumbing (figure 7-10). Utilizing air from the windshield defrost duct, the air supply system provides the pneumatic compressor inlet with clean, sea level air pressure at all altitudes.

7-52. FUNCTION OF AIR COMPRESSOR SUPPLY SYSTEM.

7-53. The air compressor supply system utilizes air from the windshield defrost duct at approximately 140 psi pressure. This air is passed through a 10-micron air filter and regulated to 32 in. Hg (15 psig) by an absolute pressure regulator before being delivered to the air inlet port of the air compressor. In this way, sea level air pressure is provided for the compressor at all altitudes.

7-54. AIR COMPRESSOR SUPPLY SYSTEM FILTER.

7-55. The air compressor supply system filter cleans the supply air before it enters the air inlet of the pneumatic compressor. In the event the stainless steel filter element is dirty or clogged, a safety relief valve built into the unit will by-pass supply air to the compressor inlet port.

The safety relief valve also prevents damage to the filter element in the event of an extremely high-pressure differential across the filter. The air filter is located in the forward end of the right-hand gun bay. The stainless steel element may be removed for cleaning. (Refer to paragraph 3-54.)

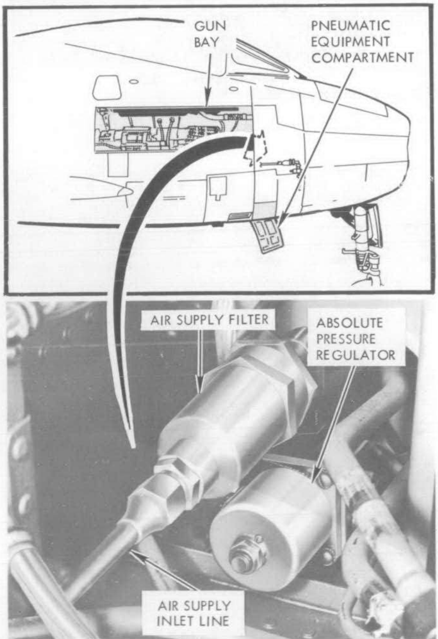
7-56. AIR COMPRESSOR SUPPLY SYSTEM ABSOLUTE PRESSURE REGULATOR.

7-57. The air compressor supply system absolute pressure regulator reduces the incoming air supply to 32 in. Hg (15 psig) before the supply air reaches the air compressor. In this way, sea level conditions are maintained at all altitudes and the compressor is prevented from cavitating. The pressure regulator is located in the forward end of the right-hand gun bay.

7-58. REMOVING AND INSTALLING AIR COMPRESSOR SUPPLY SYSTEM FILTER AND ABSOLUTE PRESSURE REGULATOR.

REMOVING

1 Remove gun bay access door and pneumatic equipment compartment access plate.



2 Disconnect air supply line from air filter housing.

3 Disconnect pressure regulator outlet line from bottom of pressure regulator. Line is accessible in pneumatic equipment compartment.

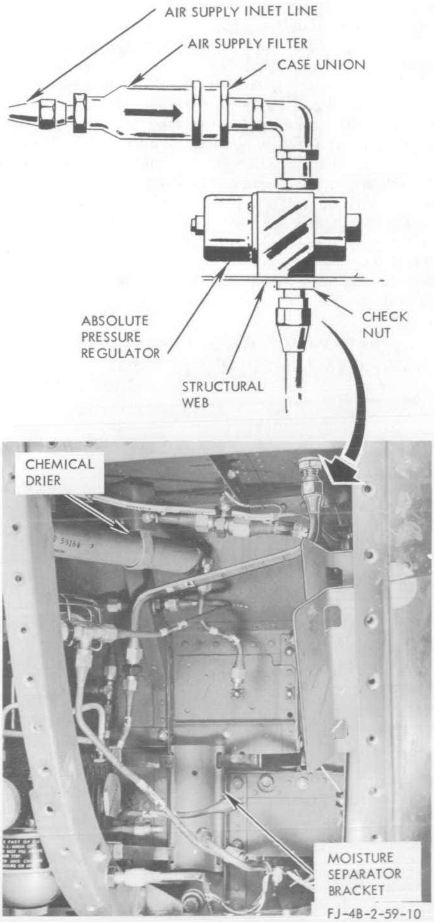
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4 Remove check nut from pressure regulator outlet line where line passes through web into pneumatic compartment.

5 Remove air filter and pressure regulator as a unit.

6 The air filter and pressure regulator may be separated by loosening the check nut on respective unit and unscrewing from fitting.

Note To remove the stainless steel element from air filter, separate the filter case at union. Refer to paragraph 3-54 to properly clean filter element.



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INSTALLING

7 Connect air filter and pressure regulator to fitting and install as a unit.

8 Install check nut on pressure regulator outlet line. Connect pneumatic line to bottom of regulator. Connect supply line to air filter housing.

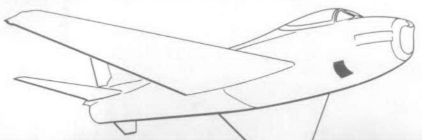
9 Install gun bay door and pneumatic equipment compartment access door.

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7-59. PNEUMATIC SYSTEM AIR COMPRESSOR.

7-60. The pneumatic system air compressor (figure 7-10) is a three-stage, piston-type, electric motor-driven unit. With an inlet air pressure of 32 in. Hg (15 psig), the compressor delivers 0.45 cfm at 1500 psi pressure. A pressure switch, controlling the compressor motor, is mounted on the compressor housing and is connected to the pneumatic system pressure, downstream of the air storage bottle. The primary purpose of the compressor is to make up for the drop in system pressure as a result of leakage, altitude, temperature and operation. It is intended that ground equipment be used to initially charge the system. The compressor is lubricated by an integral oil pump and oil sump. The oil level in the compressor oil sump should be checked prior to each flight and should register near the lower step in the sump. The oil screens should be cleaned and the oil removed and replaced with fresh oil after each 120 aircraft hours. Use lubricating oil (item 86, materials list).

7-61. REMOVING AND INSTALLING PNEUMATIC SYSTEM AIR COMPRESSOR.





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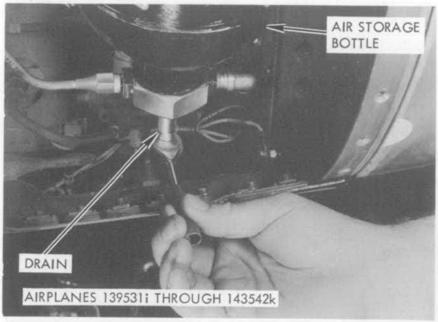
REMOVING

1 Remove electrical power from airplane electrical system.

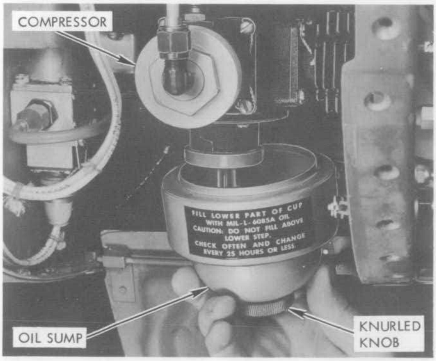
2 Open gun charger access door and remove pneumatic compartment access plate.

3 Discharge air pressure from system by opening air storage bottle drain plug.

Note To drain air storage bottles on airplanes 143543 l and subsequent, see figure 7-13A.



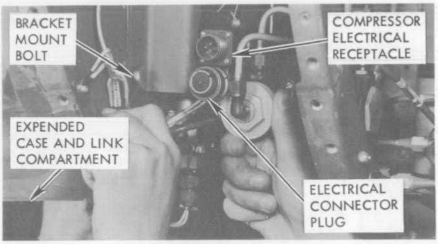
4 Remove oil sump from compressor by loosening knurled knob at bottom of sump.



5 Disconnect pneumatic lines from air compressor. Disconnect two lines at "T" fitting behind compressor, and disconnect one line from forward compressor cylinder. Leave line entering rear of pressure switch connected.

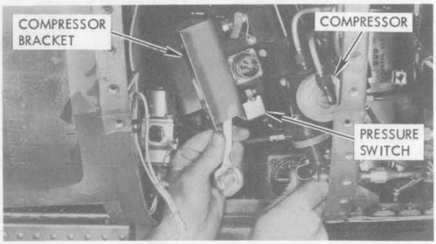
6 Disconnect electrical connector from compressor receptacle.

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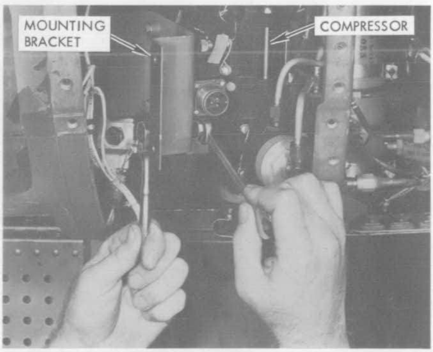


7 Remove compressor mounting bracket mount bolts. Nuts are accessible through expended link and case compartment door.

8 Cock compressor to permit access to rear of pressure switch. Disconnect pneumatic line from rear of pressure switch.

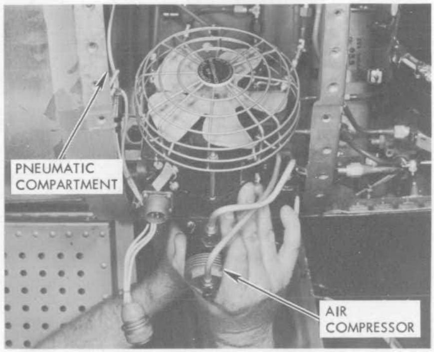


9 Remove compressor mounting bracket from compressor.



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10 Remove air compressor from pneumatic compartment.

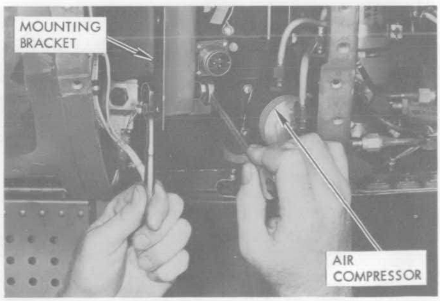


11 If compressor is to be left out of airplane, cap pneumatic lines to prevent foreign material from entering the system.

INSTALLING

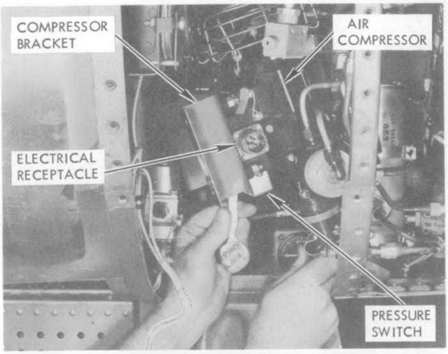
1 Place air compressor in pneumatic compartment.

2 Install compressor mounting bracket on compressor.



3 Cock compressor to permit access to rear of pressure switch. Connect pneumatic line to fitting at rear of pressure switch.

FJ-4B-2-59-14



4 Place air compressor in mounting position and install compressor mounting bolts. Mounting bolt nuts can be installed in expended case and link compartment.

5 Connect pneumatic lines to air compressor fittings. Connect two lines at "T" fitting behind compressor and connect one line at forward compressor cylinder.

6 Connect electrical connector to compressor electrical receptacle. Safety with AN995F32 safety wire.

7 Service compressor oil sump and install on air compressor. (Refer to paragraph 7-62.)

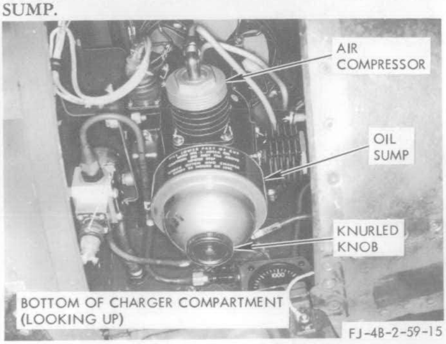
8 Charge pneumatic system from ground equipment.

9 Perform operational check of pneumatic power system. (Refer to paragraph 7-48.)

10 Install pneumatic equipment compartment access plate. Close gun charger and expended case and link compartment access doors.

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7-62. REMOVING, SERVICING AND INSTALLING PNEUMATIC SYSTEM AIR COMPRESSOR OIL SUMP.



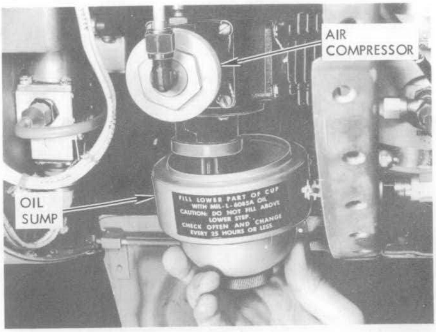
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REMOVING

1 Open gun charger access door.

2 Turn knurled knob at bottom of sump counterclockwise until sump is free of compressor.

3 Lower sump until free of oil pump assembly and remove from compressor.



SERVICING AND INSTALLING

1 Place sump on a level surface and service with oil (item 86, materials list). Do not fill above lower step in sump.

2 Place sump over oil pump assembly; mate with compressor and tighten knurled knob. Tighten knob only hand-tight.

3 Close gun charger access door.

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7-63. PNEUMATIC SYSTEM MOISTURE SEPARATOR.

7-64. The pneumatic system moisture separator (figure 7-10) partially dries the pneumatic system air by mechanically separating approximately 90 percent of the moisture from the compressed air. The unit operates at a pressure of 900 to 3000 psi and is equipped with a thermostatically controlled heater which operates within a range of 2°C to 21°C (35°F to 70°F). The moisture is collected in the separator and is automatically blown overboard through the action of the dump valve and back-pressure valve when the air compressor is de-energized.

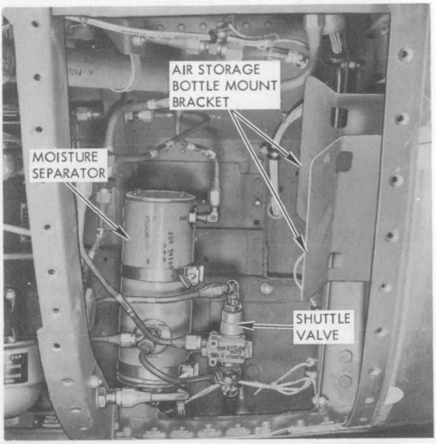
7-65. REMOVING AND INSTALLING PNEUMATIC SYSTEM MOISTURE SEPARATOR.

REMOVING

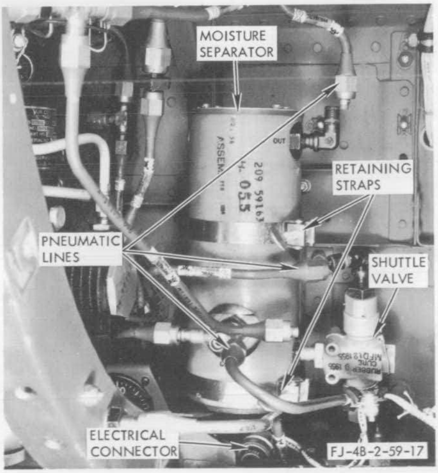
1 Remove electrical power from airplane electrical system.

2 Remove air storage bottle. (Refer to paragraph 7-88.)

3 Remove pneumatic compartment access plate.

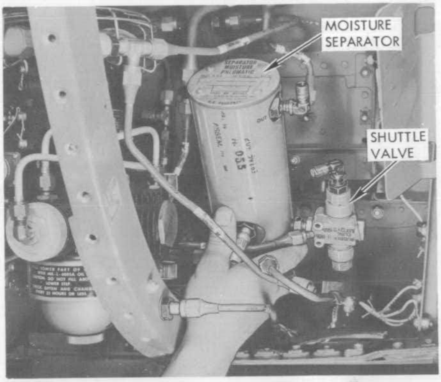


4 Disconnect pneumatic lines from moisture separator and shuttle valve and cap openings.



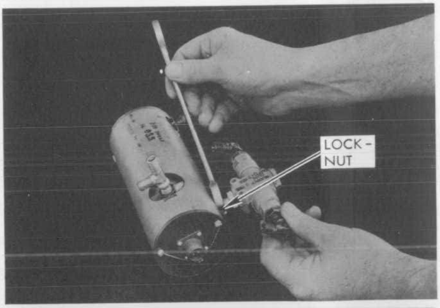
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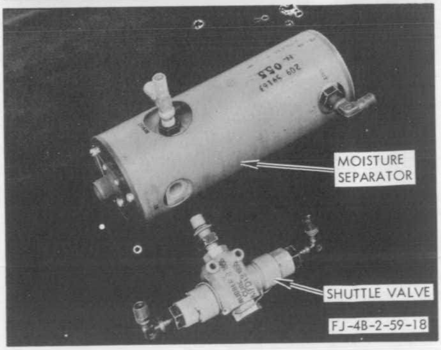
5 Disconnect electrical connector from receptacle on bottom of separator.



6 Remove retaining straps and remove moisture separator and shuttle valve as a unit.

7 Loosen locknut on shuttle valve fitting and remove shuttle valve from moisture separator.



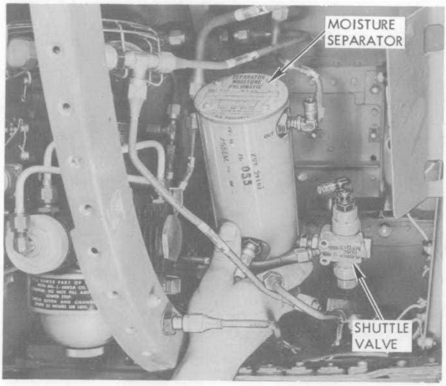


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INSTALLING

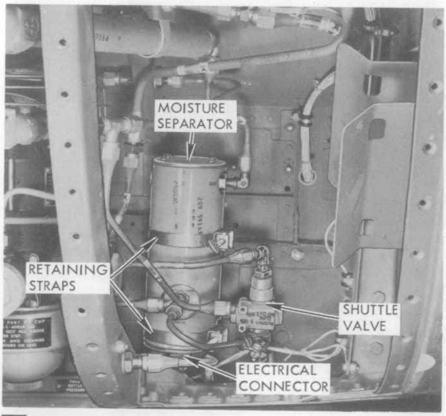
1 Install shuttle valve on moisture separator.

2 Place moisture separator in mounting position and tighten retaining straps.



3 Connect electrical connector to receptacle at bottom of moisture separator. Safety with AN995F32 wire.

4 Remove caps and connect pneumatic lines to moisture separator and shuttle valve fittings.



5 Install air storage bottle. (Refer to paragraph 7-88.)

6 Perform operational check of pneumatic power system. (Refer to paragraph 7-48.)

7 Install pneumatic compartment access plate.

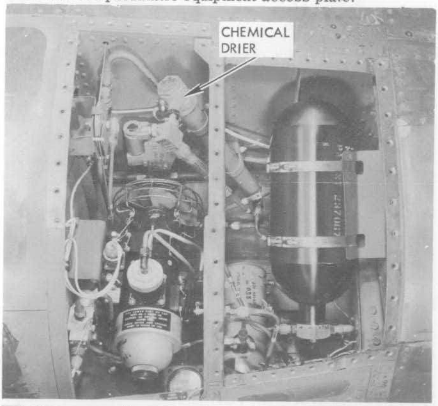
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7-66. PNEUMATIC SYSTEM CHEMICAL DRIER.

7-67. The pneumatic system chemical drier (figure 7-10) consists of a tubular housing and a silica gel desiccant cartridge. The chemical drier is installed downstream from the mechanical moisture separator and further dries the air before delivery to the air storage bottle. The chemical drier is located in the pneumatic compressor compartment. The cartridge is accessible by removing the outboard cap from the housing and should be replaced after each 30 hours of operation.

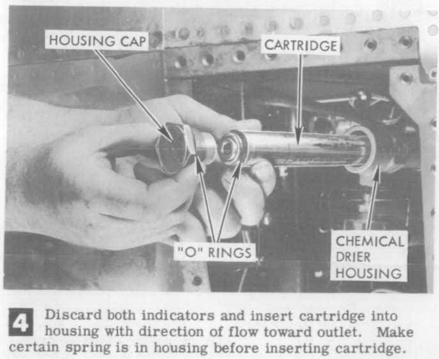
7-68. CHECKING AND REPLACING PNEUMATIC SYSTEM CHEMICAL DRIER CARTRIDGE.

1 Remove pneumatic equipment access plate.



2 Remove cap from chemical drier housing and remove cartridge.

3 Remove caps and moisture indicators from both ends of the new replacement cartridge. Moisture indicators must be blue in color.



4 Discard both indicators and insert cartridge into housing with direction of flow toward outlet. Make certain spring is in housing before inserting cartridge.

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5 Install housing cap. Make certain both outboard end of cartridge and housing cap have "O" ring seals installed.

6 Tighten housing cap. Install pneumatic equipment access plate.

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7-69. PNEUMATIC SYSTEM OVERBOARD DUMP VALVE.

7-70. The pneumatic system overboard dump valve (figure 7-10) is a normally open, solenoid-operated valve. The solenoid holds the valve closed any time the electric compressor motor is energized. When electrical power is removed from the compressor motor, power is also removed from the dump valve solenoid, allowing the valve to open and release trapped air pressure from the pneumatic system pressure lines. The draining action creates a pressure differential in the moisture separator, allowing pressure to dump through the overboard vent.

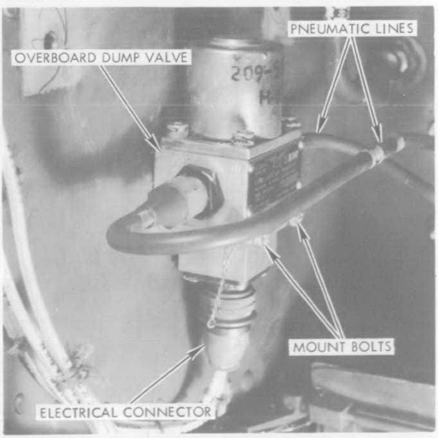
7-71. REMOVING AND INSTALLING PNEUMATIC SYSTEM OVERBOARD DUMP VALVE.

REMOVING

1 Remove electrical power from airplane electrical system.

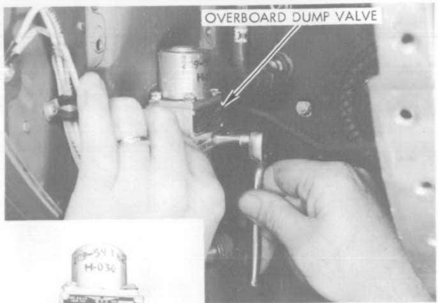
2 Remove pneumatic compartment access plate.

3 Disconnect pneumatic lines from valve and cap openings. Disconnect electrical connector from valve receptacle.



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4 Remove two bolts and washers securing valve to fuselage structure.





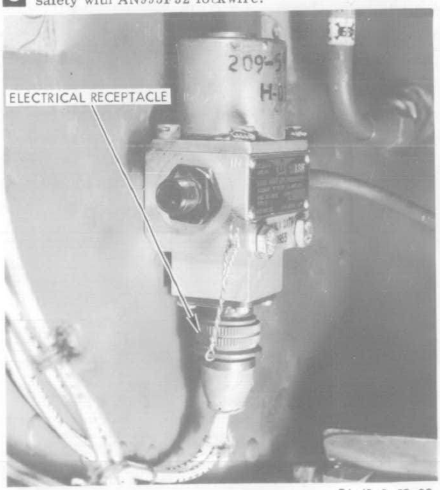
5 Remove valve from airplane.

INSTALLING

1 Position valve to fit on fuselage structure so that electrical connection is pointing down and name plate is facing forward.

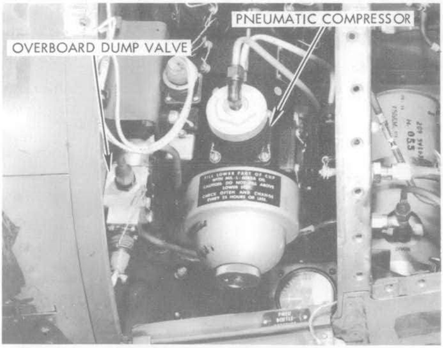
2 Secure valve to fuselage structure with two bolts and washers.

3 Connect electrical connection to valve receptacle and safety with AN995F32 lockwire.



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4 Remove caps and connect pneumatic lines to valve.



5 Install pneumatic compartment access plate.

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7-72. PNEUMATIC SYSTEM BACK-PRESSURE VALVE.

7-73. The back-pressure valve (figure 7-10) is located immediately downstream from the mechanical moisture separator and chemical drier and has a cracking pressure of 300 psi. When the pneumatic dump valve opens, the mechanical moisture separator drain valve opens, dumping trapped air pressure overboard. This action reduces air pressure at the inlet side of the back-pressure valve below cracking pressure (300 psi), allowing air pressure to flow back through the valve and through the moisture separator, removing the moisture accumulated in the separator unit.

7-74. REMOVING AND INSTALLING PNEUMATIC SYSTEM BACK-PRESSURE VALVE.

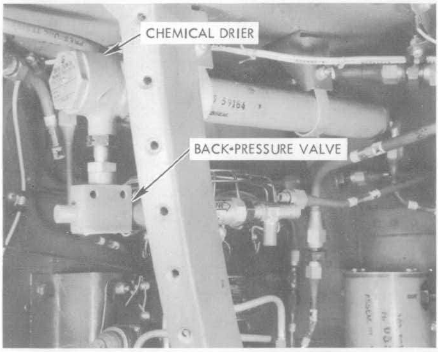
REMOVING

1 Discharge air pressure from pneumatic system.

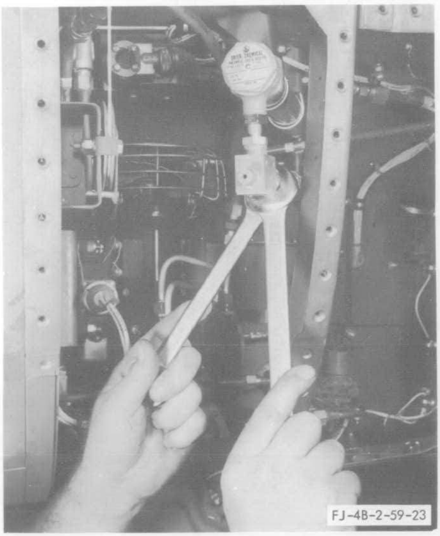
Note Check valve must be removed before back-pressure valve can be removed.

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2 Disconnect pneumatic lines at "T" fitting inboard of check valve and cap openings.

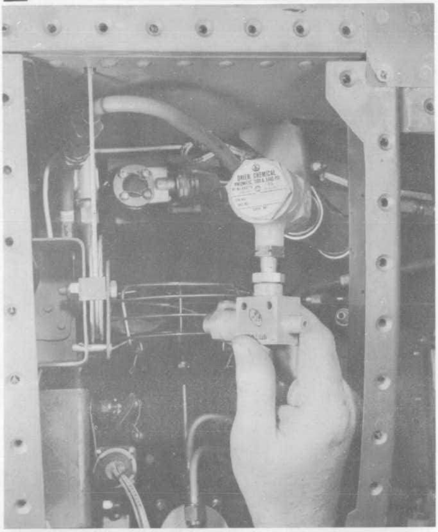


3 Remove check valve from back-pressure valve.

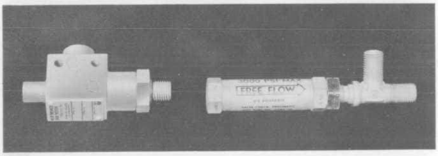


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4 Remove back-pressure valve from chemical drier.



INSTALLING



1 Install back-pressure valve on chemical drier.

2 Install check valve on back-pressure valve.

3 Remove caps and connect pneumatic lines to "T" fitting.

4 Install pneumatic compartment access plate.

5 Charge pneumatic system from ground equipment.

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7-75. PNEUMATIC SYSTEM PRESSURE RELIEF VALVE.

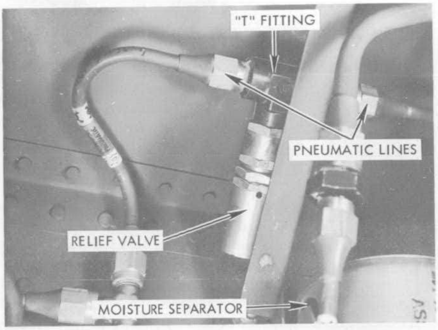
7-76. Should the pressure switch malfunction and the compressor continue to operate, or if a rise in temperature should cause excessive pressure, the pressure relief valve (figure 7-10) will crack at 1750 psi pressure. The valve will reseat when pressure decreases to 1575 psi. The pressure relief valve vents pressure overboard.

7-77. REMOVING AND INSTALLING PNEUMATIC SYSTEM PRESSURE RELIEF VALVE.

REMOVING

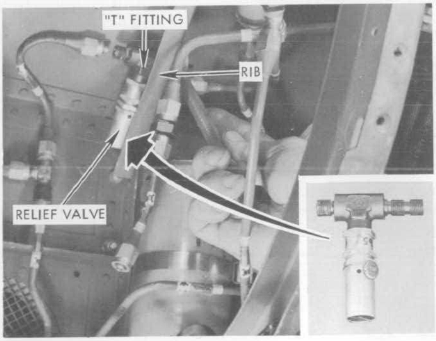
1 Discharge air pressure from storage bottle. (Refer to paragraph 7-48.)

2 Disconnect pneumatic lines from relief valve "T" fitting and cap openings.



3 Support valve and remove check nut securing "T" fitting to structural rib.

4 Remove valve from airplane.



INSTALLING

1 Install valve in mounting position and install check nut securing "T" fitting to structural rib.

2 Remove caps and connect pneumatic lines to "T" fitting.

3 Charge pneumatic system from ground equipment.

4 Install pneumatic system compartment access plate.

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7-78. PNEUMATIC SYSTEM PRESSURE SWITCH.

7-79. The pneumatic system pressure switch (figure 7-10) is an integral part of the compressor motor. The pressure switch controls the compressor motor, opening or closing the electrical circuit to stop or start the motor. When pneumatic pressure in the system drops to a minimum of 1050 psi, the pressure switch will actuate, closing the electrical circuit to the compressor motor. When system pressure reaches a maximum of 1650 psi, the pressure switch will open the circuit to the motor.

7-80. PNEUMATIC SYSTEM CHECK VALVE.

7-81. The pneumatic system check valve (figure 7-10) is located between the moisture removing equipment and the air storage bottle. The check valve allows free airflow into the air storage bottle and prevents any airflow back through the pneumatic system pressure lines.

7-82. REMOVING AND INSTALLING PNEUMATIC SYSTEM CHECK VALVE. Refer to paragraph 7-74.

7-83. PNEUMATIC SYSTEM SHUTTLE VALVE.

7-84. The pneumatic system shuttle valve (figure 7-10) is installed in the mechanical moisture separator inlet line to permit pneumatic system charging from ground equipment. The shuttle valve directs air from ground equipment into the moisture separator during ground charging and moves to close off the ground charging line during normal compressor operation.

7-85. REMOVING AND INSTALLING PNEUMATIC SYSTEM SHUTTLE VALVE. Refer to paragraph 7-65.

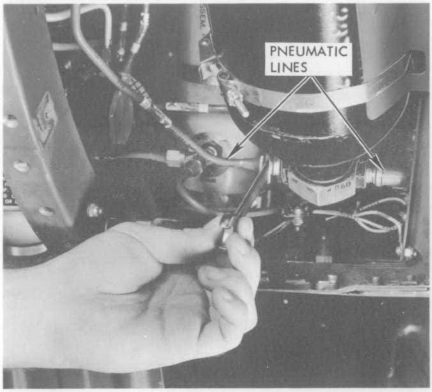
7-86. PNEUMATIC SYSTEM AIR STORAGE BOTTLE.

7-87. The shatterproof air storage bottle (figure 7-10) has a 200-cubic inch capacity and is equipped with a moisture drain valve. The bottle employs an inverted-type mounting and is located in the pneumatic equipment compartment. The air storage bottle maintains a supply of pressurized air for use by the gun chargers and buffers.

7-88. REMOVING AND INSTALLING PNEUMATIC SYSTEM AIR STORAGE BOTTLE.

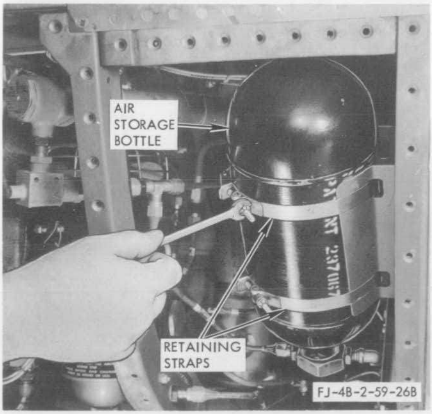
REMOVING

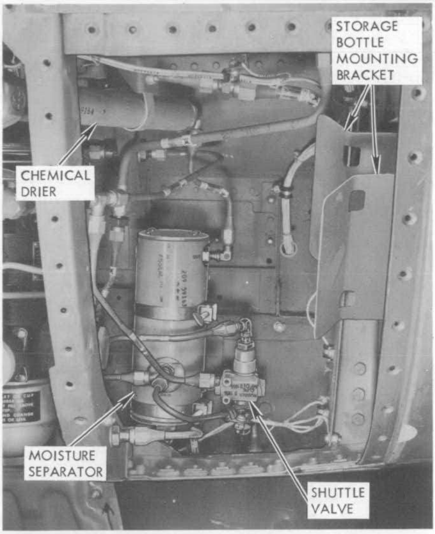
1. Remove pneumatic compartment access plate.
2. Discharge air pressure from air storage bottle. (Refer to paragraph 7-48.)
3. Disconnect pneumatic lines from air storage bottle and cap openings.



Note On airplane 143543I and subsequent, disconnect air storage bottle drain line.

4. Remove storage bottle retaining straps and remove bottle from airplane.





INSTALLING

1 Place air storage bottle in mounting position and install retaining straps.

2 Remove caps and connect pneumatic lines to storage bottle fittings.

Note On airplanes 1435431 and subsequent, connect air storage bottle drain line.

3 Perform pneumatic system operational check. (Refer to paragraph 7-48.)

4 Install pneumatic compartment access plate.

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7-89. PNEUMATIC SYSTEM 25-MICRON AIR FILTER.

7-90. A 25-micron air filter (figure 7-10) is incorporated in the pneumatic system to filter air from the storage bottle before the air is routed to the gun charging valve and gun components. The filter is made of sintered bronze and removes all particles larger than 25 microns in size.

7-91. REMOVING AND INSTALLING PNEUMATIC SYSTEM 25-MICRON FILTER.

REMOVING

1 Remove pneumatic compartment access plate.

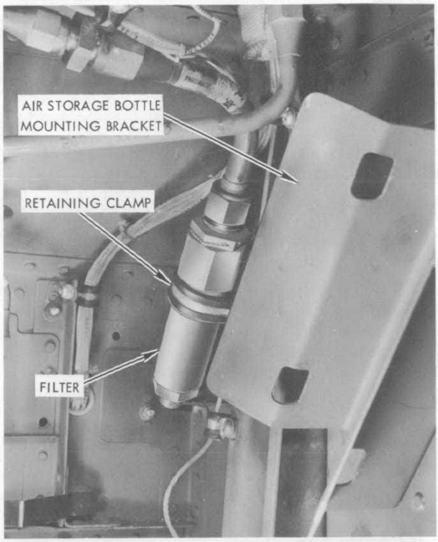
2 Discharge air pressure from air storage bottle. (Refer to paragraph 7-48.)

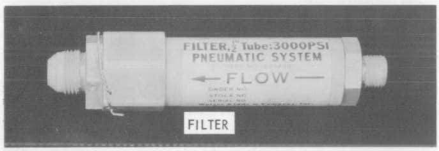
3 Remove air storage bottle. (Refer to paragraph 7-88.)

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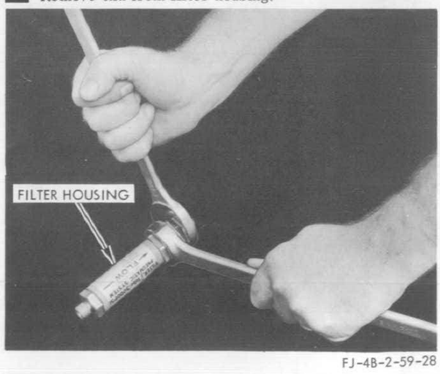
4 Disconnect pneumatic lines from filter and cap openings.

5 Loosen filter retaining clamp sufficiently to slip filter out of clamp. Remove filter from airplane.



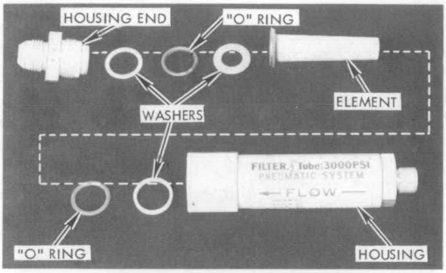


6 Remove end from filter housing.



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7 Remove "O" rings, washers and bronze filter element from housing. (To clean filter element, refer to paragraph 3-54.)



INSTALLING

1 Install "O" rings, washers and element in filter housing.

2 Install end on housing and safety with AN995F32 lockwire.

3 Place filter in retaining clamp and tighten clamp. Arrow on filter housing should be pointing up.

4 Remove caps and connect pneumatic lines to filter.

5 Install air storage bottle. (Refer to paragraph 7-88.)

6 Perform pneumatic system check. (Refer to paragraph 7-48.)

7 Install pneumatic compartment access plate.

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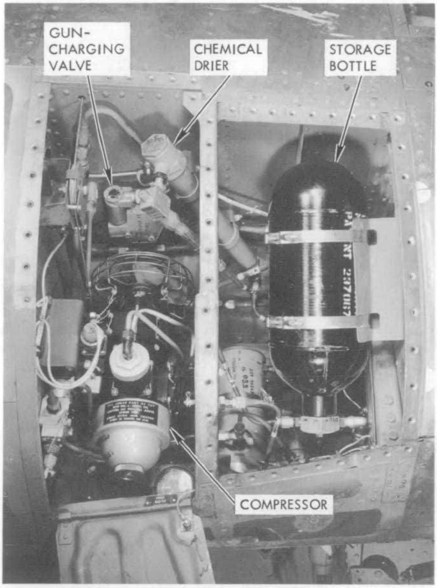
7-92. PNEUMATIC SYSTEM PRESSURE GAGE.

7-93. An air pressure gage (figure 7-10) is incorporated in the pneumatic system and is located in the pneumatic equipment compartment immediately below the air compressor. The gage is accessible through the gun charger access door. The pressure gage is calibrated in increments of 100 psi from 0 to 2000 psi.

7-94. PNEUMATIC SYSTEM GUN CHARGING VALVE.

7-95. The gun charging valve (figure 7-10) is a normally open, solenoid-operated valve that controls the flow of air pressure from the gun pneumatic system to the gun charger units. When the valve is energized, downstream pressure is vented to the atmosphere, allowing air pressure behind the gun charger pistons to bring the gun bolts into battery position. When the charging valve is de-energized, air pressure is routed to the forward side of the gun charger pistons. Due to the larger piston area on the forward side of the charger piston, the charger will hold the gun bolt in the retracted position. The charging valve has an operating pressure range of from 1500 psi to 100 psi pressure. The charging valve is located at the aft end of the pneumatic equipment compartment. The valve may be operated through the gun control switch or the valve may be operated manually by depressing the override button on the valve housing.

7-96. REMOVING AND INSTALLING PNEUMATIC SYSTEM GUN CHARGING VALVE.



REMOVING

1 Remove pneumatic compartment access plate.

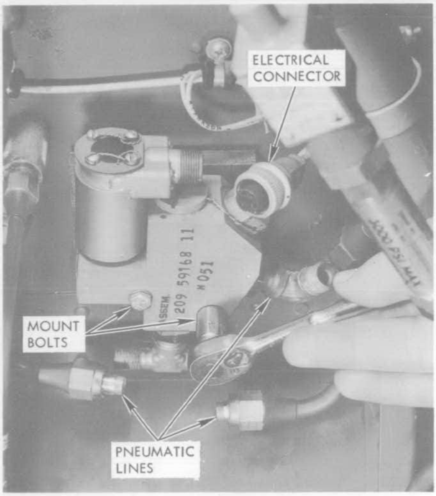
2 Discharge air pressure from air storage bottle. (Refer to paragraph 7-48.)

3 Disconnect electrical connector from valve receptacle.

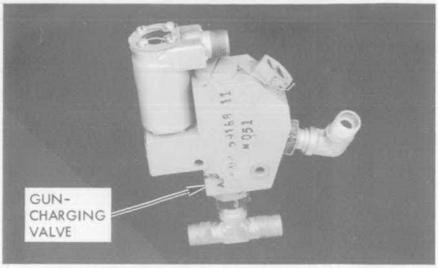
4 Disconnect pneumatic lines from valve fittings and cap openings.

5 Remove mount bolts and washers securing valve to fuselage structure.

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6 Remove gun-charging valve from airplane.



INSTALLING

1 Place gun-charging valve in mounting position and install mount bolts securing valve to fuselage structure.

2 Remove caps and connect pneumatic lines to valve fittings.

3 Connect electrical connector to valve receptacle and safety with AN995F32 lockwire.

4 Perform pneumatic system check. (Refer to paragraph 7-48.)

5 Install pneumatic compartment access plate.

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GUN BAY PURGING SYSTEM

7-97. GUN BAY PURGING SYSTEM.

7-98. The gun bay purging system (figure 7-16) clears the gun bays of dangerous accumulations of explosive gases during and after gun firing. If not exhausted, these gases may explode with sufficient force to cause severe structural damage to the airplane. Two electrically energized, hydraulically operated gun bay purge entrance doors open into the engine air intake duct to scavenge these gases. Simultaneously, four electrically energized, hydraulically operated gun bay purge exit doors open into the outside air stream. The gun bay purging system is composed of an electrical actuating switch (gun trigger switch), a solenoid-operated hydraulic control valve, a time delay relay unit, actuating cylinders and entrance and exit purge doors. When the gun trigger switch is depressed to the second detent, the solenoid-operated hydraulic valve directs utility hydraulic pressure at operating pressure to the actuating cylinders. The actuating cylinders open the purge entrance doors into the engine air intake duct and open the purge exit doors at the rear of the gun bay doors. The doors remain fully open during firing and for a period of 5 seconds after release of the trigger switch due to the action of the time delay relay unit. The solenoid-operated valve remains energized on "close" for 20 seconds following the 5-second time delay, closing the purge doors. With the purge doors open, sufficient ram air passes through the gun bay area to completely change the air twice every second.

7-99. FUNCTION OF GUN BAY PURGING SYSTEM — OPENING CYCLE.

7-100. When the gun trigger switch is depressed to the second detent to initiate gun firing, the timer clutch in the time delay relay unit is electrically energized and disengages the camshaft from the timer motor. Spring action then rotates the camshaft backward to reposition the two microswitches. The first of these switches routes electrical power to the timer motor and to the second switch. The circuit to the door opening solenoid of the purge door hydraulic control valve is completed through the second switch. With the hydraulic control valve in the "open" position, utility hydraulic system pressure is directed to the purge door actuating cylinders, extending the purge entrance doors into the engine air intake duct and extending the purge exit doors into the air stream (figure 7-17). The timer motor does not drive any part of the time delay relay during the opening cycle. A portion of the ram air passing through the gun bays is vented overboard through two purge exit doors at the aft end of each gun bay access door. The purge exit doors are hydraulically actuated by utility hydraulic system pressure at the same time the purge entrance doors are actuated. A hydraulic actuating cylinder and mechanical linkage in each gun bay actuate the exit doors. The remaining ram air circulates through the ammunition chutes and openings in the floor of the gun bays, down through the ammunition and expended case compartments and overboard through louvers in the doors of the expended case compartments.

7-101. FUNCTION OF GUN BAY PURGING SYSTEM — CLOSING CYCLE.

7-102. Releasing the gun trigger switch opens the circuit between the armament bus and the time delay relays, de-energizing the clutch and allowing the camshaft to engage with the timer motor. The cam lobes on the camshaft are so spaced that 5 seconds after the camshaft begins to turn, the first lobe actuates the switch controlling the hydraulic control valve solenoids. This switch then transfers electric power from the opening solenoid of the control valve to the closing solenoid. Utility hydraulic pressure is now directed to the closing side of the purge door actuating cylinders, closing the purge doors (figure 7-18). Twenty seconds after the first switch is actuated, the second camshaft lobe contacts the second switch, opening the circuit to the timer motor and the hydraulic control valve. During the 25-second period in which the timer motor turns the camshaft, a tension spring secured to the camshaft is wound tight. When the purge door opening cycle is again initiated, this spring unwinds and rotates the camshaft backward. The purge entrance doors are held in the closed position by an overcenter linkage which is secured in the overcenter position by a spring clip on the bell crank assembly.

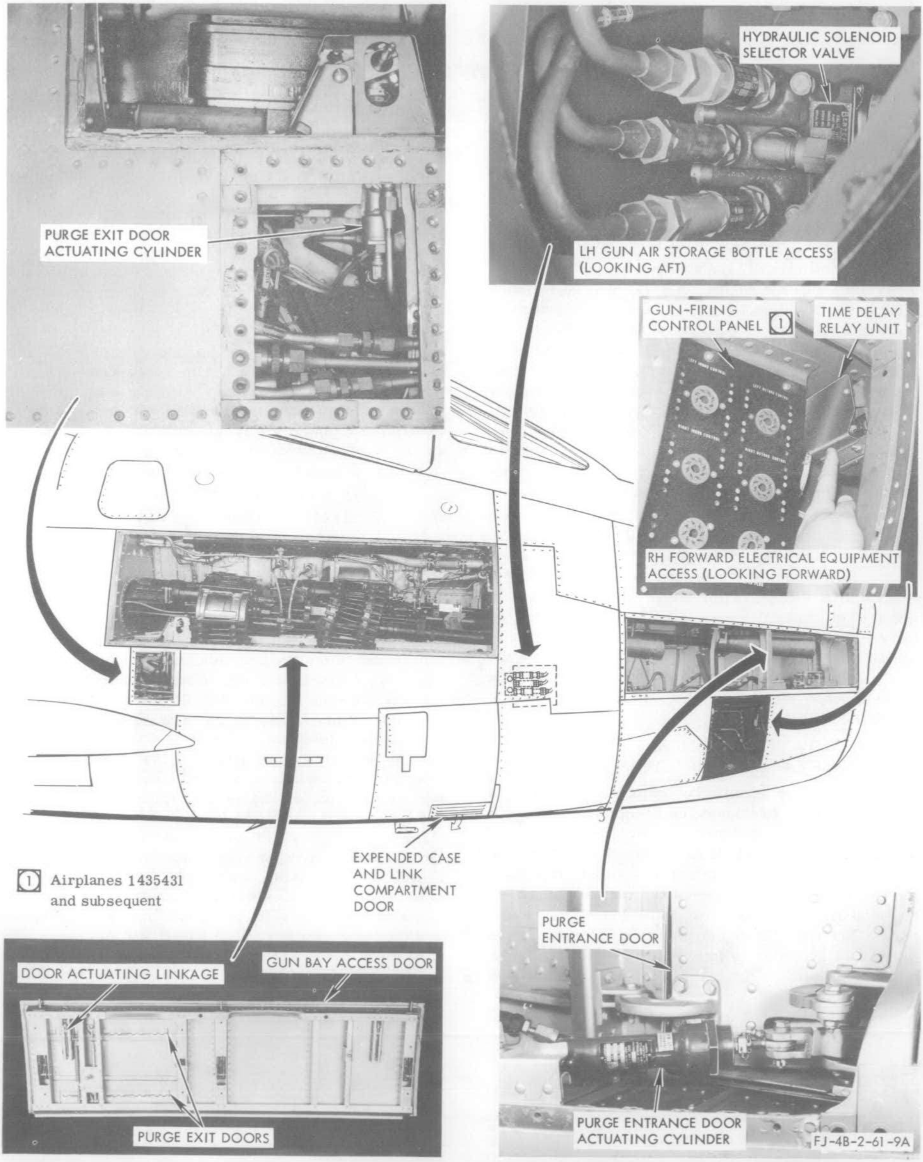


Figure No. 7-16. Gun Bay Purging System Unit Location

7-103. TROUBLE SHOOTING GUN BAY PURGING SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
DOORS FAIL TO OPEN.		
Faulty gun trigger switch.	With electrical power on the armament bus, engage GUN BAY PURGE, BOMB & GUN TRIGGER and PURGE VALVE & CAMERA TEST circuit breakers. Depress gun trigger switch to second detent and check for presence of 28 volts dc at terminal 1 on terminal strip mounted on time delay relay unit mounting bracket. The time delay relay unit is accessible through the right-hand forward hydraulic equipment access door.	Replace gun trigger switch and/or defective wiring component.
Faulty time delay relay unit.	With electrical power on armament bus, applicable circuit breakers engaged and trigger switch depressed to the second detent, check for presence of 28 volts dc at terminal 4 on terminal strip mounted on time delay relay unit mounting bracket.	Replace time delay relay sealed unit.
Faulty solenoid-operated control valve "open" solenoid.	If trigger switch and time delay relay unit check out satisfactorily, disconnect electrical connector from receptacle on control valve unit. Connect jumper lead between receptacle pin "C" and connector pin socket "O." With applicable circuit breakers engaged and gun trigger switch depressed to second detent, check for presence of 28 volts dc at pin "A" in control valve receptacle.	Replace control valve unit.
Insufficient hydraulic pressure.	With electrical power on airplane's a-c electrical system, engage HYD PRESS IND* (HYD & OIL PRESS IND†) fuse, turn HYD PRESS SELECTOR to "UTILITY" and read utility hydraulic system pressure.	Refer to paragraph 3-7.
Defective hydraulic actuating cylinder and/or actuating bell crank.	Visually inspect actuating cylinder, piston rods and actuating bell crank for defects.	Replace defective components.
Exit door linkage misrigged.	Inspect exit door linkage for correct rigging and adjustment.	Refer to paragraph 7-120.

*Airplanes 139531i through 143542k
†Airplanes 143543l and subsequent

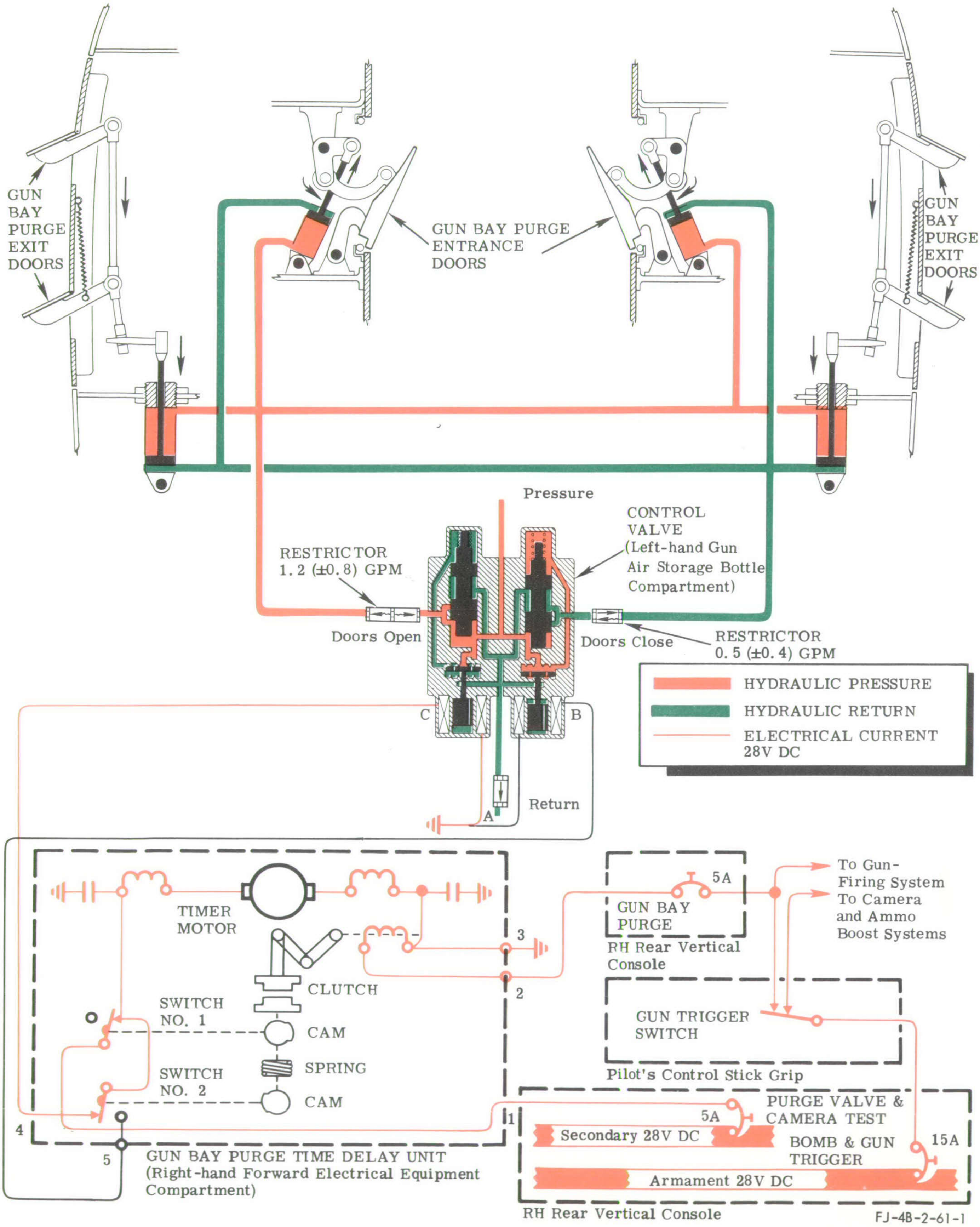


Figure No. 7-17. Gun Bay Purging System—Doors Opening

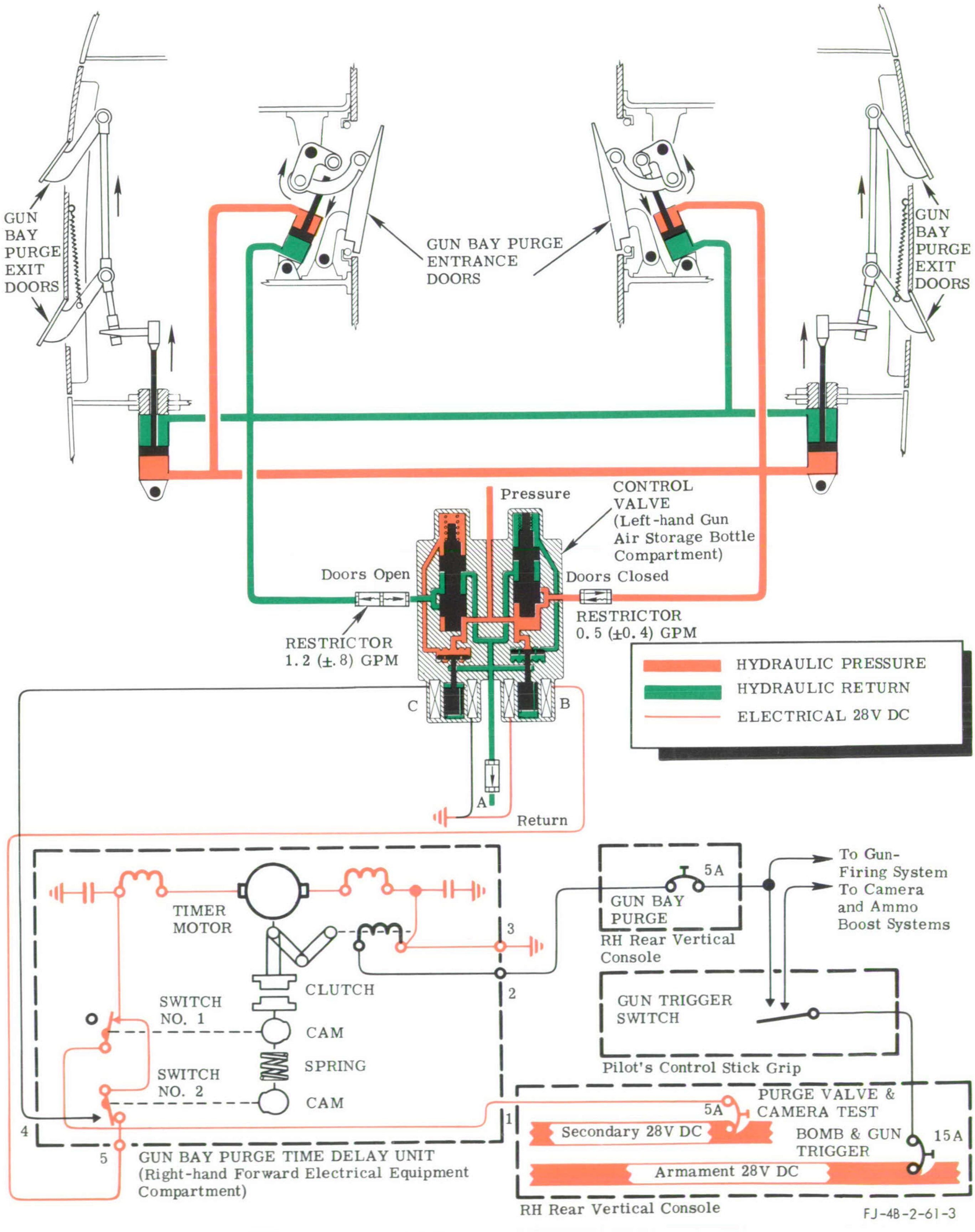


Figure No. 7-18. Gun Bay Purging System—Doors Closing

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
DOORS FAIL TO CLOSE AFTER TRIGGER SWITCH IS RELEASED.			
Solenoid-operated control valve not operating electrically due to one or a combination of the following:			
a. Defective control valve.	Check between test point AGE and ground.	28 volts dc.	Replace defective control valve.
		Zero volts.	Continue trouble shooting.
b. Defective time delay relay unit.	Check between test points AGB, AGC and ground.	28 volts dc at test point AGB and zero volts at test point AGC.	Replace defective time delay relay unit.
		Zero volts at test point AGB.	Replace defective power wire to time delay relay unit.
		28 volts dc at test point AGC.	Continue trouble shooting.
c. Defective trigger switch or wiring.	Check between test point AGD and ground.	Zero volts.	No action.
		28 volts dc.	Replace defective control stick grip.
Hydraulic actuating cylinder by-passing fluid to return.			Replace defective actuating cylinder.
DOORS CLOSE IMMEDIATELY UPON RELEASE OF TRIGGER SWITCH.			
Defective time delay relay unit.			Replace defective time delay relay unit.
ELECTRICAL POWER FAILURE.			
Defective circuit breaker.	Check between test points PCC and PCD and ground.	28 volts dc.	Replace defective circuit breaker.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
DOOR OR DOORS FAIL TO COME TO THE FULLY CLOSED OR FLUSH POSITION.			
Hydraulic actuating cylinder improperly adjusted.			Properly adjust actuating cylinder. (Refer to paragraphs 7-117 and 7-123.)

7-104. OPERATIONAL CHECK OF GUN BAY PURGING SYSTEM.

7-105. To perform an operational check of the gun bay purging system, proceed as follows:

a. Connect an external electrical power source to airplane.

b. Connect hydraulic test stand to ground test connection panel and set to operate for 13 gpm output at 3000 psi.

WARNING

Prior to accomplishing the following procedure, make sure that ammunition is unloaded and ensure that no ammunition remains in the system.

c. Position BOMB & GUN TRIGGER (right-hand rear vertical console), PURGE VALVE & CAMERA TEST (right-hand rear vertical console) and GUN BAY PURGE (right-hand rear vertical console) circuit breakers in.

d. Position ARMAMENT BUS (right-hand rear vertical console) circuit breaker in, ARM MASTER switch to "ON" and momentarily depress GROUND FIRING CONTROL switch to energize armament bus.

e. Depress gun trigger switch on control stick grip to second detent. Gun bay purge entrance and exit purge doors should instantly open (1/3 to 1/2 second). Release trigger switch. There should be a 5-second time delay before doors close. After 5 seconds, the doors should instantly close (1/2 to 1 second).

Note

The purge door solenoid-operated control valve should remain energized for approximately 20 seconds after the doors reach the closed position.

f. Operate doors through several cycles and check for proper fit and mechanical interference. Check for external leakage of hydraulic lines and components.

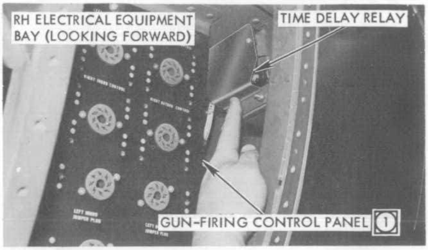
g. Disconnect external electrical power source from airplane.

h. Exhaust hydraulic pressure and disconnect test stand.

7-106. GUN BAY PURGING SYSTEM TIME DELAY RELAY UNIT.

7-107. The gun bay purging system time delay relay unit (figure 7-16) provides automatic opening and closing of the gun bay purge doors during the gun firing cycle. The time delay relay unit consists of an electric motor, an electrically operated clutch, a two-lobe camshaft and two microswitches. The entire unit is encased in a nitrogen-filled airtight case. The unit is mounted in the forward end of the right-hand electrical equipment bay and is accessible through the right-hand electrical equipment bay access panel. During the opening cycle, the clutch is energized, disengaging the camshaft from the timer motor. A tension spring drives the camshaft during the opening cycle. The camshaft actuates the two microswitches, routing electrical power to the solenoid-operated control valve "open" solenoid and to the timer motor. During the closing cycle, the clutch is de-energized, engaging the camshaft with the timer motor. The timer motor drives the camshaft during the closing cycle, rewinding the tension spring at the same time. The camshaft actuates the first microswitch 5 seconds after the closing cycle is initiated, routing electrical power to the solenoid-operated control valve "close" solenoid. The second microswitch is actuated 20 seconds later, removing electrical power from the time delay relay unit.

7-108. REMOVING AND INSTALLING GUN BAY PURGING SYSTEM TIME DELAY RELAY UNIT.

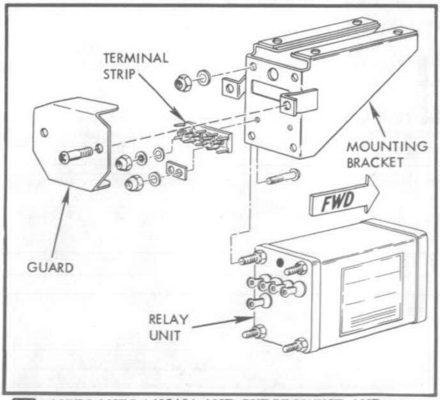


REMOVING

1. Remove electrical power from airplane electrical system.
2. Remove forward right-hand electrical equipment compartment access panel.

Note On airplanes 1435431 and subsequent, and airplanes with Service Change No. 449 complied with, the gun-firing control panel must be partially removed before the time delay relay unit can be removed.

3. Remove screws from relay unit guard and remove guard.
4. Disconnect the four wires from terminal strip on face of relay unit.
5. Disconnect ground wire from ground connection on airplane frame.
6. Remove the four nuts from relay mounting studs and remove relay from mounting bracket.



1 AIRPLANES 1435431 AND SUBSEQUENT AND AIRPLANES HAVING SERVICE CHANGE NUMBER 449 COMPLIED WITH. FJ-4B-2-61-10B

INSTALLING

1. Install relay unit in mounting position in mounting bracket.
2. Install the four nuts on relay mounting studs and torque to 15 (±3) inch-pounds.
3. Connect electrical leads to terminal strip on face of relay unit.
4. Connect ground electrical lead to ground connection on airplane frame.
5. Install relay unit guard.
6. Install forward right-hand electrical equipment compartment access panel.

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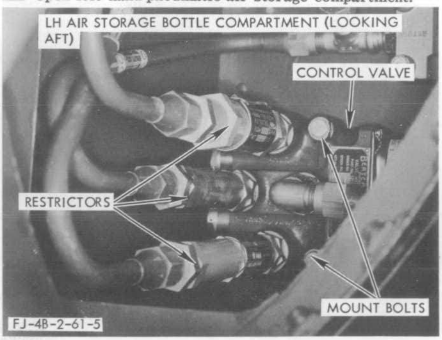
7-109. GUN BAY PURGING SYSTEM SOLENOID-OPERATED CONTROL VALVE.

7-110. The gun bay purging system solenoid-operated control valve is located in the air storage bottle compartment on the left-hand side of the forward fuselage. The control valve includes two separate solenoid-operated selector valves with a common pressure and return port in a single housing. Each valve consists of a sliding spool, a return spring and a solenoid. One valve controls the closing of the purge doors and the other controls the opening of the purge doors. When in the energized position, each valve directs pressure to either open or close the purge doors. When in the de-energized position, each valve provides a return port for the same portion of the system to which it previously directed pressure. Spring tension returns the valve spools to their normal position when the solenoids are de-energized.

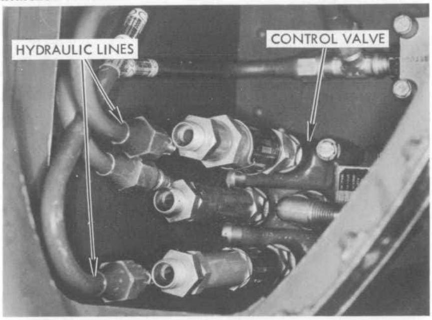
7-111. REMOVING AND INSTALLING GUN BAY PURGING SYSTEM SOLENOID-OPERATED CONTROL VALVE.

REMOVING

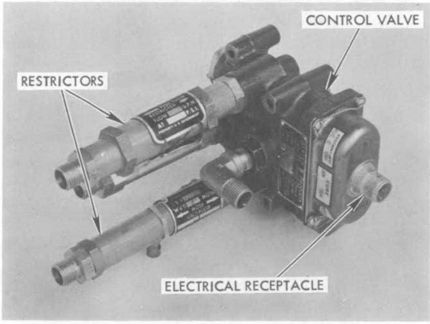
1. Remove electrical power from airplane electrical system.
2. Open left-hand pneumatic air storage compartment.



3. Make certain that hydraulic pressure is relieved from utility hydraulic system.
4. Disconnect hydraulic lines from solenoid-operated control valve and cap openings. Leave restrictors attached to valve.



5. Disconnect electrical connection from valve receptacle.



6. Support valve and remove two bolts and washer securing valve to fuselage structure. Remove valve and attached restrictors from airplane.

INSTALLING

1. Position valve to fit on fuselage structure and secure with bolts and washers.
2. Remove caps and connect hydraulic lines to valve. Connect electrical connection to valve receptacle and safety with AN995F32 lockwire.
3. Check operation of gun bay purge system. (Refer to paragraph 7-104.)
4. Replace access panel.

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7-112. GUN BAY PURGE ENTRANCE DOORS.

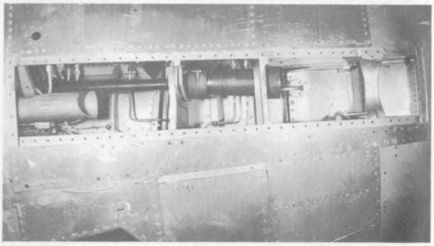
7-113. The gun bay purge entrance doors are located on each side of the forward fuselage and open into the engine air intake duct. (See figure 7-16.) When in the open position, the doors are designed to direct a flow of ventilating air through the gun bays and ammunition compartments. The doors are actuated to the open and closed position by hydraulic actuating cylinders. An overcenter type linkage that is retained by a leaf spring locks each door in the closed position. The actuating cylinders, when bottomed in the extended position, limit each door's travel toward the open position.

7-114. REMOVING, INSTALLING AND ADJUSTING GUN BAY PURGE ENTRANCE DOOR.

REMOVING

Caution Check to make sure gunnery system is disarmed and electrical power is removed from armament bus.

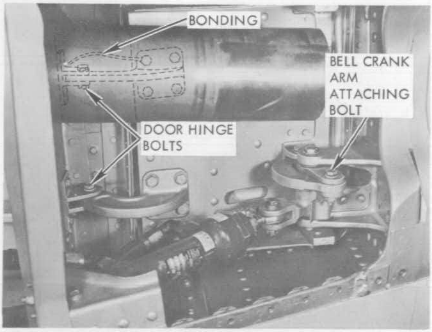
1 Remove gun blast panel from airplane. (Refer to paragraph 7-24.)



2 Remove bolt attaching bell crank arm to door actuating arm.

3 Remove the two door hinge bolts and disconnect door bonding.

4 Remove door assembly through engine air intake.



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INSTALLING

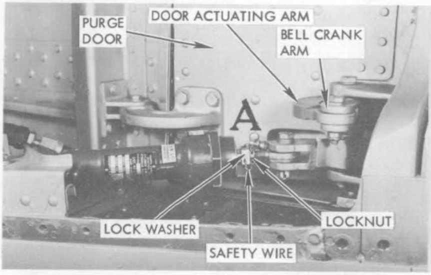
Caution Check to make sure gunnery system is disarmed and electrical power is removed from armament bus.

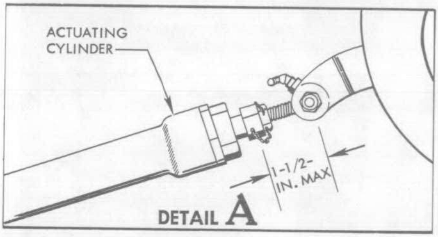
1 If gun blast panel is installed, remove mounting screws, move blast panel forward to disengage blast tubes and remove blast panel from airplane.

2 Place door assembly in mounting position through engine air intake duct.

3 Install the two door hinge bolts and connect door bonding.

4 Install bolt connecting door actuating arm to bell crank arm.





5 With door in closed position, adjust hydraulic actuating cylinder if necessary.

A. Adjust actuating cylinder rod end to bring door into fully closed or flush position.

Caution Do not exceed dimension shown in detail A.

B. When adjustment is complete, safety locknut with AN995F32 safety wire to adjacent actuating rod lock washer.

Note The door must come fully closed when actuating cylinder is hydraulically actuated to retracted position.

6 Engage blast tubes with blast panel opening. Move blast panel aft to mounting position and install.

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7-115. GUN BAY PURGE ENTRANCE DOOR ACTUATING CYLINDER.

7-116. The gun bay purge entrance door hydraulic actuating cylinders operate on 3000 psi utility hydraulic system pressure. Each cylinder consists of a cylinder body, a piston with an adjustable rod end and fittings for connection of hydraulic pressure and return lines. The actuating cylinders are located directly outboard of each gun bay purge door. The actuating cylinder is mounted to the fuselage structure by means of a trunnion at the aft end of the cylinder body and is free to pivot horizontally. The cylinder piston rod end is connected to the purge door bell crank actuating arm. The actuating cylinders are accessible by removing the gun blast panels.

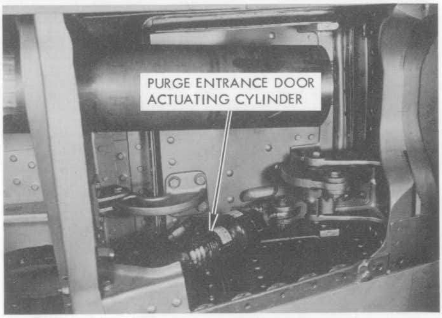
7-117. REMOVING, INSTALLING AND ADJUSTING GUN BAY PURGE ENTRANCE DOOR ACTUATING CYLINDER.

REMOVING

1 Remove respective gun blast panel. (Refer to paragraph 7-24.)

2 Exhaust hydraulic pressure.

3 Disconnect two hydraulic lines and cap openings.



4 Remove cotter pin, nut, bolt and washers securing rod end of actuating cylinder to purge door mechanism.

5 Remove cotter pin, nut, bolt and washers securing trunnion end of actuating cylinder to fuselage structure.

6 Remove cylinder from airplane.

FJ-4B-2-61-14

INSTALLING

1 Position trunnion end of cylinder to fit at attaching point on fuselage structure and secure with washers, bolt, nut and cotter pin.

Note The hydraulic fitting on cylinder body should be facing inboard.

2 With actuating cylinder fully retracted, adjust at rod end to bring purge door into fully closed position. Tighten locknut and safety with AN995F32 lockwire.

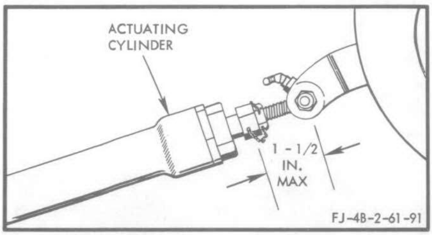
Note Do not exceed rod end dimension shown.

3 Secure rod end to purge door mechanism with washers, bolt, nut and cotter pin.

4 Remove caps and connect hydraulic lines to cylinder.

5 Check purge doors for proper operation. (Refer to paragraph 7-104.)

6 Install blast panel. (Refer to paragraph 7-24.)



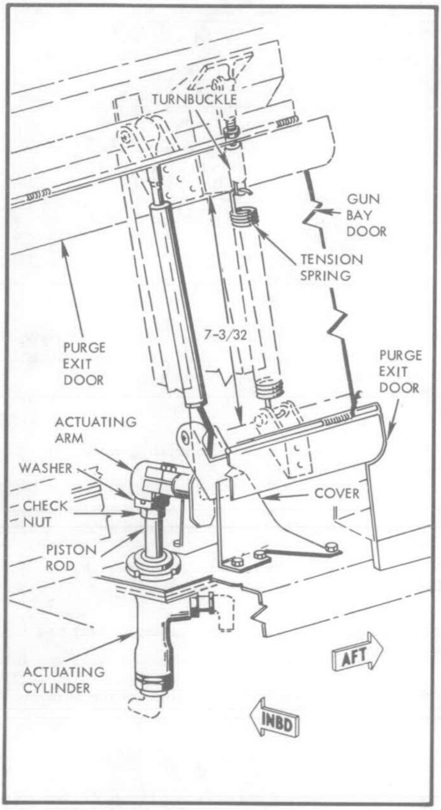
FJ-4B-2-61-91

7-118. GUN BAY PURGE EXIT DOORS.

7-119. Two interconnected, tandem-mounted gun bay purge exit doors, located on each gun bay access panel, open into the air stream. The exit doors open simultaneously with the entrance doors to provide an exit for the ventilating air through the gun bay. Each set of tandem-mounted doors is interconnected by mechanical linkage and is actuated to the open and closed position by a single hydraulic actuating cylinder. The exit doors are preloaded to the closed position by springs. The actuating cylinders, when bottomed in the retracted position, limit the travel of each set of doors toward the open position.

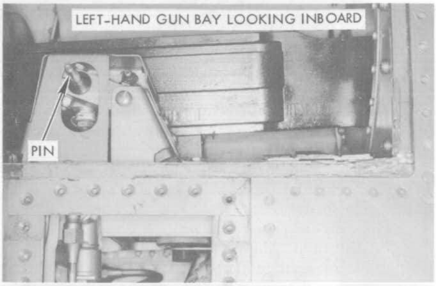
7-120. REMOVING, INSTALLING AND ADJUSTING GUN BAY PURGE EXIT DOORS.

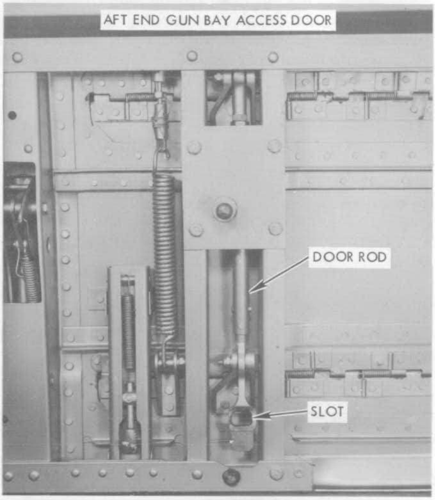
1 Remove gun bay access door.



2 Adjust tension spring in gun bay door to 7-3/32 inches in length. Safety turnbuckle with AN995F41 safety wire.

FJ-4B-2-61-15





3 Remove cover from actuating cylinder assembly.

4 Adjust hydraulic piston rod end, with piston in fully extended position under normal operating pressure, or cylinder blocked fully extended, so that pin engages hole in door rod end when gun bay door is installed. Purge exit doors must be closed flush.

5 Install gun bay door and actuate cylinder to open purge exit doors. Check angle of opening. Doors must open a minimum of 45 degrees.

6 Actuate cylinder to close purge exit doors and check that doors close flush.

7 Remove gun bay door; tighten hydraulic piston rod end check nut and safety check nut to washer with AN995F32 safety wire.

8 Install cover on actuating cylinder assembly.

9 Install gun bay access door.

FJ-4B-2-61-16

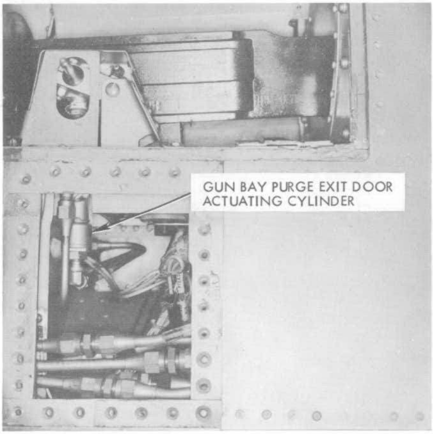
7-121. GUN BAY PURGE EXIT DOOR ACTUATING CYLINDER.

7-122. A hydraulic actuating cylinder mounted in each gun bay actuates each set of tandem-mounted gun bay purge exit doors to the open and closed positions. The gun bay purge exit door actuating cylinders operate on 3000 psi utility hydraulic system pressure simultaneously with the purge entrance doors. The doors are interconnected by a mechanical linkage (figure 7-16). The hydraulic actuating cylinder is mounted vertically with the cylinder body extending below the floor of the gun bay. The cylinder piston rod and rod end extend above the gun bay floor. The piston rod end is connected to the purge exit door linkage by a floating actuating pin which engages the pin receptacle on the exit door linkage when the gun bay door is installed. The purge exit door actuating cylinder is accessible through the gun bay access door and the electrical equipment access plate immediately aft of and below the gun bay access door.

7-123. REMOVING AND INSTALLING GUN BAY PURGE EXIT DOOR ACTUATING CYLINDER.

REMOVING

1 Remove respective gun bay access door and the access panel directly below gun bay.



2 Remove cover from exit door actuating mechanism on floor of gun bay.

3 Exhaust hydraulic pressure, disconnect two hydraulic lines from actuating cylinder and cap openings.

4 Disconnect rod end of actuating cylinder from door actuating mechanism.

5 Break safety wire and remove check nut securing cylinder to gun bay floor.

6 Remove cylinder from airplane through access panel below gun bay.

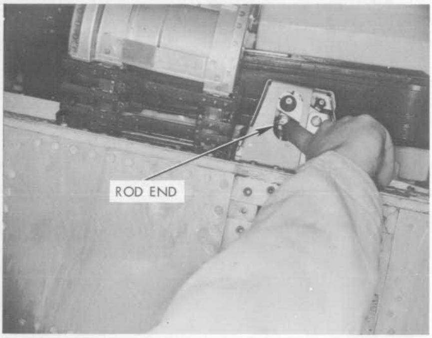
INSTALLING

1 Insert cylinder rod end up through hole in gun bay floor and install check nut. Safety with AN995F32 lockwire.

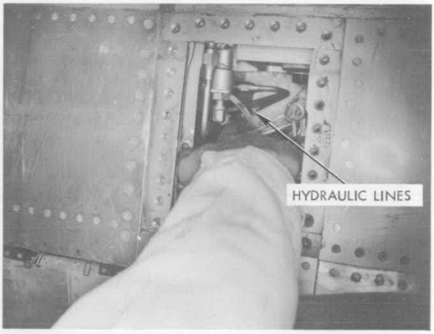
Note Position cylinder so upper hydraulic fitting is facing outboard.

FJ-4B-2-61-17

2 Adjust rod end of fully extended actuating cylinder to permit tapered actuating pin to engage receptacle of actuating rod on gun bay door and connect to actuating mechanism. Safety locknut with AN995F32 lockwire.



3 Remove caps and connect hydraulic lines to cylinder.



4 Install gun bay access door and operate purge doors. (Refer to paragraph 7-104.) Check angle exit doors open. Doors must open a minimum of 45 degrees. Readjust cylinder rod end if necessary.

5 Remove gun bay access door and install cover.

6 Install access door and panel.

FJ-4B-2-61-92A

7-124. DISASSEMBLING AND ASSEMBLING GUN BAY PURGE EXIT DOOR ACTUATING CYLINDER.

DISASSEMBLY

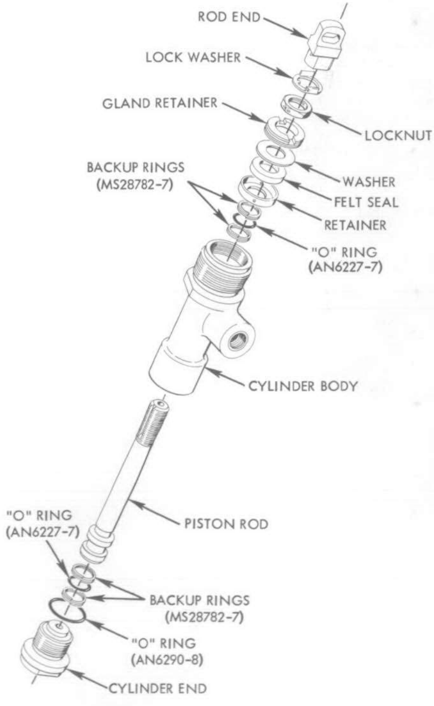
1 Secure actuating cylinder in holding device and remove hydraulic fittings.

2 Loosen locknut securing rod end and remove rod end, lock washer and locknut from piston rod.

3 Break safety wire and remove gland retainer, washer, felt seal and retainer from end of cylinder body.

4 Remove cylinder end from cylinder body.

5 Remove piston rod from cylinder body.



Note Clean all metal parts with Stoddard Solvent (item 119, materials list).

FJ-4B-2-61-7

ASSEMBLY

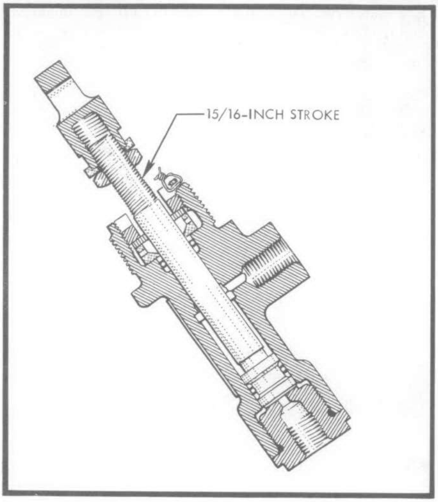
Note Prior to assembly, inspect all metal parts for cleanliness and condition; replace as required. Replace all "O" ring packings and backup rings. (Refer to General Information, Section III.)

BEARING TOLERANCE CHART		
NOMENCLATURE	NORMAL DIMENSION	REPLACE AT
CYLINDER BODY ID	.499 / .501	.502
CYLINDER BORE ID	.376 / .377	.378
PISTON HEAD OD	.496 / .497	.495
PISTON ROD OD	.372 / .373	.371

1 Assemble cylinder in reverse sequence of disassembly procedure.

2 After assembly is complete, check cylinder break-out friction by hand. Break-out friction shall not exceed 40 pounds. Piston must move in and out smoothly.

3 To proof test cylinder, apply 4500 psi for two minutes, first at one port and then the other, with the piston bottomed at the opposite end and the opposite port open. There shall be no external or internal leakage or damage to the cylinder.



4 To test the cylinder for external leakage, operate cylinder through five complete cycles at 3000 psi. Leakage around piston rod shall not exceed one drop in 25 cycles.

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GUN CAMERA SYSTEM

7-125. GUN CAMERA SYSTEM.

7-126. An AN-N6A camera (figure 7-19), equipped with a 90-degree erector head, is mounted on the Mark 8 Mod 8 sight unit mount on the instrument panel shroud. The sight reticle camera records the position of the sight reticle images and the target during gun firing and for a preset overrun period after firing. The sight reticle camera is energized through the gun trigger switch any time the trigger switch is depressed to either the first or second detent (figure 7-20). The camera will continue to operate as long as the trigger switch is depressed and for a preset overrun period of from 0 to 5 seconds after the trigger switch is released. During the overrun period, an overrun indicator pin is projected into the camera film aperture and is photographed as a film record of overrun. The camera may be test operated through the camera test switch (CAMERA TEST) located on the canopy deck test switch panel. The camera is equipped with an integral heater which maintains operating temperature within the camera body. The camera mount attaches to the Mark 8 Mod 8 sight unit mount by means of mating dovetail plates and is retained in place by a thumbscrew. The camera mount is preset in relation to the Mark 8 Mod 8 sight unit mount so that bore sighting the sight unit also bore sights the camera. The camera may be removed and installed without affecting bore-sight adjustments by loosening the dovetail plate thumbscrew.

Note

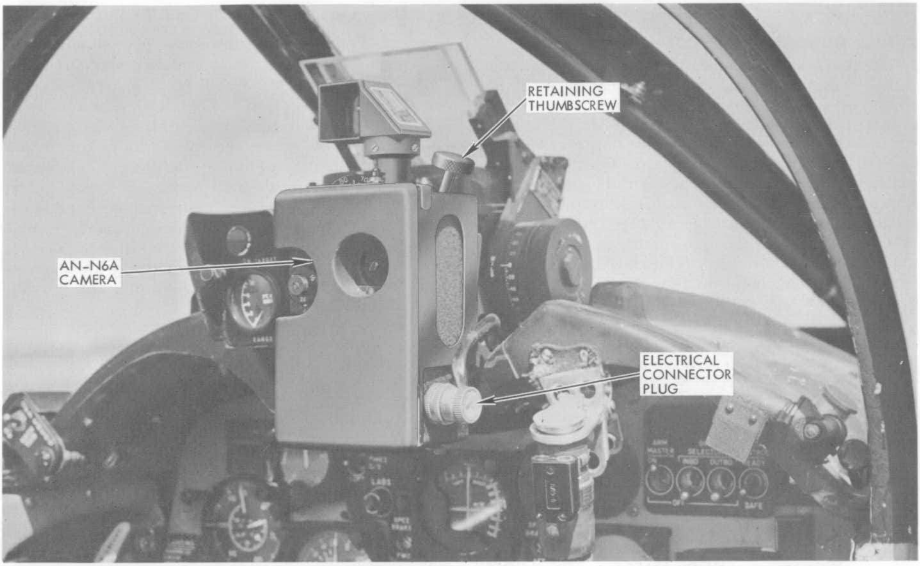
If Service Change No. 493 has been complied with, the camera may be operated without operating the guns or ammo boost motors, by placing the GUN CONTROL switch in the "SAFE" position.

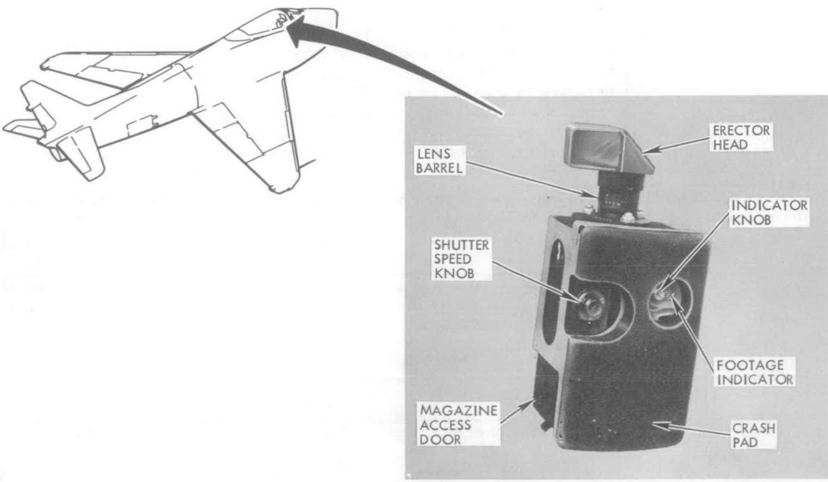
7-127. TROUBLE SHOOTING GUN CAMERA SYSTEM.

TEST EQUIPMENT: D-C voltmeter.

SYSTEM CONDITIONS: 28-volt d-c power applied to airplane.
Ammunition removed from all guns.
GUN CONTROL switch in "SAFE" position.
GUN SELECTOR switches in "OFF" positions.
Armament bus energized.
GUN CAMERA & CANOPY BUS, PURGE VALVE & CAMERA TEST, BOMB & GUN TRIGGER and AMMO BOOST & GUN CAMERA circuit breakers engaged.
MODE SELECT switch in "OFF" position.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
MOTOR FAILS TO OPERATE.			
Motor brushes worn.	Remove camera cover; remove brush retaining screws from each side of brush retaining assembly and visually inspect brushes.		Replace brushes.
Defective camera.	Actuate CAMERA TEST switch to "CAMERA TEST." Observe to determine if camera operates. If camera does not operate, check between test points BA and BC, and BB and BC.	28 volts dc in each case.	Replace defective camera.
		Other than 28 volts dc between test points BA and BC or BB and BC.	Continue trouble shooting.
Defective CAMERA TEST switch or associated wiring.	Check between test point BD and ground with CAMERA TEST switch in "CAMERA TEST" position.	28 volts dc.	Replace defective wire to test point BA.
		Other than 28 volts dc.	Continue trouble shooting.
	Check between test point BE and ground with CAMERA TEST switch in "CAMERA TEST" position.	28 volts dc.	Perform wire segment continuity check to test point BB and replace defective radio noise filter or wiring as required.
		Other than 28 volts dc.	Continue trouble shooting.
	Check test point BF to ground.	28 volts dc.	Replace defective CAMERA TEST switch.
		Other than 28 volts dc.	Replace defective power wire to PURGE VALVE & CAMERA TEST circuit breaker.





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Figure No. 7-19. Gun Camera

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
CAMERA OPERATED BY USE OF TEST SWITCH CANNOT BE OPERATED FROM TRIGGER SWITCH.			
Defective CAMERA TEST switch or associated wiring.	Check between test points BE and BG and ground.	28 volts dc.	Continue trouble shooting.
		Other than 28 volts dc at test point BE.	Replace CAMERA TEST switch.
		Other than 28 volts dc at test point BG.	Replace defective power wire.

WARNING

Before performing the following isolation procedures, check to ensure that no ammunition is in or available to guns.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
Defective CAMERA TEST switch.	Actuate gun trigger switch and maintain at first detent. Check between test points BD and BH and ground.	28 volts dc.	Continue trouble shooting.
		Other than 28 volts dc at test point BD.	Replace CAMERA TEST switch.
Defective pilot's stick grip or associated wiring.	Actuate gun trigger switch and maintain at first detent. Check between test points BJ and BK and ground.	28 volts dc.	Perform wire segment continuity check to test point BH and replace defective circuit breaker or wire segment as required.
		Other than 28 volts dc at test point BJ.	Replace defective pilot's stick grip assembly.
		Other than 28 volts dc at test point BK.	Replace defective power wire.
POWER FAILURE.			
Defective circuit breaker.	Check between test points PJB, PCC, PCD and ground.	28 volts dc.	Replace defective circuit breaker.
		Other than 28 volts dc.	Refer to paragraph 8-60, Trouble Shooting D-C Power Distribution System.
MOTOR RUNS, CAMERA FAILS TO OPERATE.			
Speed setting knob in neutral position.	Visually check position of speed setting knob.		Set knob to desired camera speed.
Internal gear and/or clutch failure.	Remove camera cover and visually inspect camera components for damage.		Replace camera.
GEAR TRAIN STOPS; CLUTCH ON CAMERA MOTOR SLIPS.			
Jammed magazine.	Remove magazine and allow motor stall cutout to cool. Check camera operation with magazine removed.		Replace defective magazine.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
MAGAZINE JAMS.			
Magazine driving spline not properly engaged.	Remove magazine and visually check magazine and driving spline for damage.		Install serviceable magazine. Make certain magazine is inserted all the way into camera and driving spline is fully engaged. Magazine chamber access cover should close easily.
Damaged magazine.	Visually check magazine for damage.		Replace magazine.
Improper operation of film claw.	Install magazine in a similar camera installation and check for proper operation.		Replace camera.
Improper operation of magazine driving spline.	Install magazine in a similar camera installation and check for proper operation.		Replace camera.
FILM IMAGE BLURRED AND/OR FILM DOUBLE EXPOSED.			
Improper operation of film claw and/or magazine driving spline.			Replace camera.
NEGATIVES OUT OF FOCUS.			
Lens assembly securing nuts loose.	Visually inspect lens assembly mounting.		Using a lens nut wrench, tighten lens mounting nuts fully, securing lens assembly to camera body.
Dirty filter and/or lens.	Visually check lens and filter for cleanliness.		Clean lens and filter with a soft brush or lens tissue.

7-128. GUN CAMERA.

7-129. The AN-N6A gun camera is equipped with a constant-speed electric motor, a gear train drive mechanism and clutch, an overrun control, a camera speed selector, a camera film footage indicator and an electrical 40-watt resistor camera body heater. The camera has a 35mm focal length lens and filter with a maximum aperture of 3.5. Two knurled adjustment rings on the lens housing provide for setting lens aperture and anticipated light conditions. The lens index ring is set to correspond with the camera speed control knob setting. The lens diaphragm ring is set to the anticipated light condition or to the desired diaphragm stop. A system of speed change gears contained within the camera body and controlled by the shutter speed knob on the camera cover permits selection of three different shutter speeds: 16, 32 or 64 frames per second. The spring clutch and motor stall cutout switch prevent damage to the camera if the magazine jams or an overload condition occurs. The built-in overrun control is adjustable in one-second increments and operates the camera for a period of from 1 to 5 seconds after the gun trigger switch is released. An overrun indicator, projected into the film aperture during the overrun period, identifies the portion of the film exposed during the overrun period. A film footage indicator, provided on the camera, indicates the amount of unexposed film remaining in the film magazine. The magazine itself incorporates an additional footage indicator for reference when the magazine is removed from the camera. When fully loaded, the film magazine holds 50 feet of 16mm motion picture film. Temperature control within the camera case is accomplished by a 40-watt resistor heater automatically controlled by a thermal switch. The heater operates when the temperature drops to 7°C (45°F) and cuts off when the temperature reaches 37.8°C (100°F). Pin jacks are provided on the camera body for the use of a lens and filter heater (not used in this installation). An aligning indicator, which fits into the camera magazine chamber, is used to bore sight the camera.

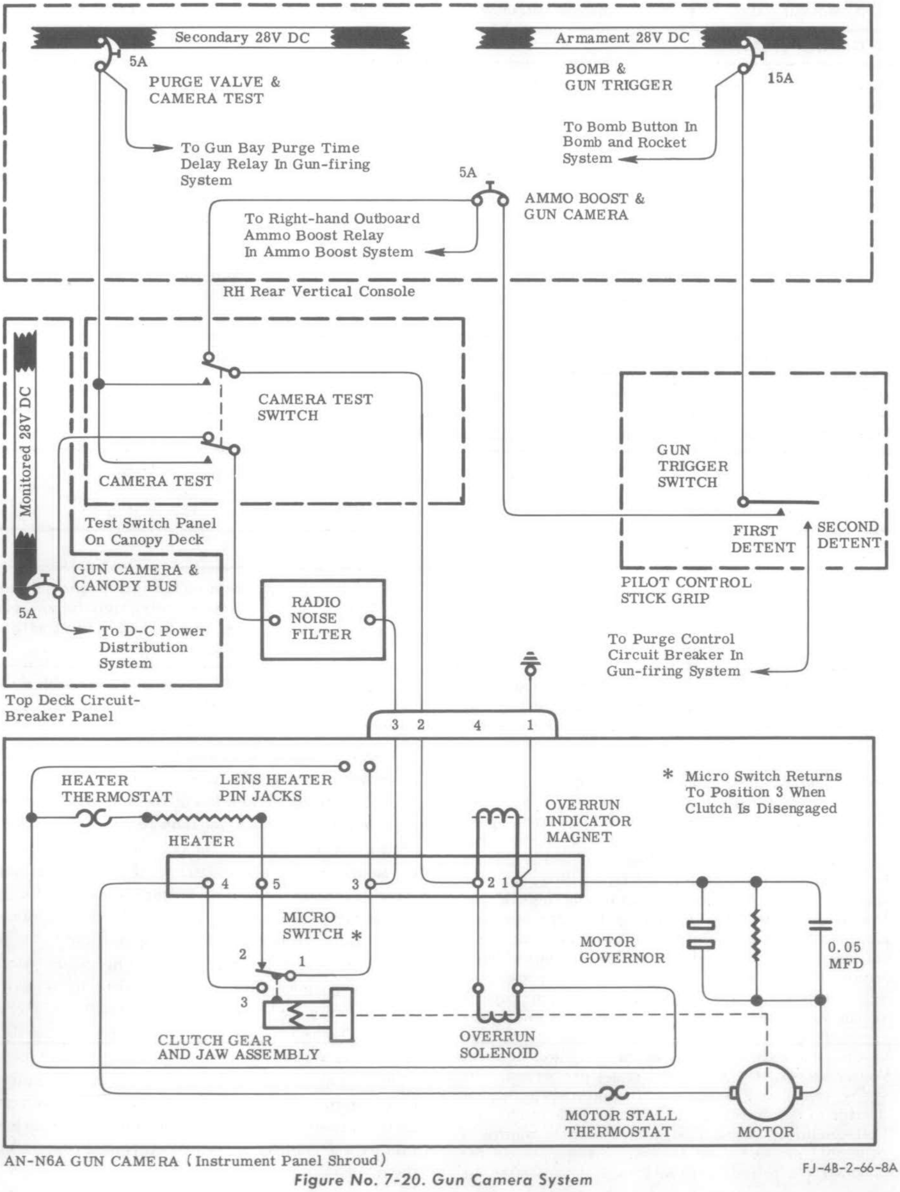
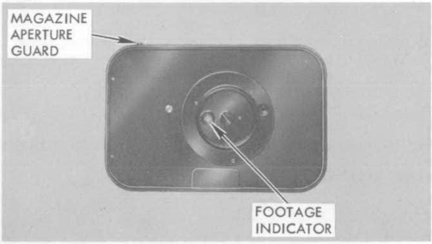


Figure No. 7-20. Gun Camera System

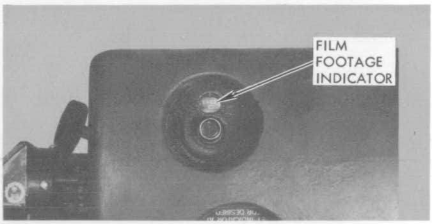
7-130. LOADING, SETTING AND INSTALLING GUN CAMERA.

LOADING

1 Note number of feet of unexposed film in magazine by referring to magazine footage indicator visible through window on forward side of magazine.

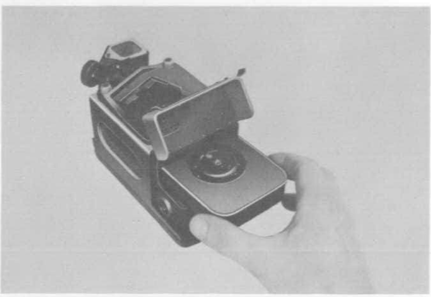


2 Set camera film footage indicator to same number as that of the magazine indicator. Camera indicator is set by turning indicator knob adjacent to indicator window.



3 Open film magazine access door at bottom of camera and fold back.

4 Insert magazine into camera magazine chamber, inserting end with aperture first and placing side of magazine with footage indicator toward mount side of camera.

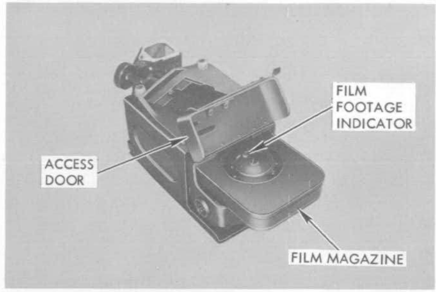


5 Close film magazine access door.

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UNLOADING

1 Pull open film magazine access door at bottom of camera and fold back.



2 Pull film magazine out of camera, making sure that magazine aperture guard slides over magazine aperture.

3 Number of feet of unexposed film remaining in magazine is indicated by film footage indicator, visible through window on forward side of magazine.

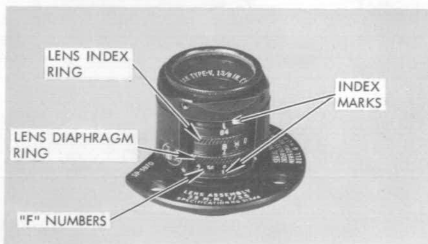
SETTING

1 Set the shutter speed for either 16, 32, or 64 exposures per second as desired. Set shutter speed by turning speed knob on camera cover to align desired shutter speed with index mark on cover.

Note Never change shutter speeds while camera is operating and always have index marks on shutter speed knob exactly aligned with index mark on camera cover.

2 Set desired shutter speed on upper part of lens index ring against index mark on lens barrel. Always have ring on lens and shutter speed knob on camera cover set to the same shutter speed.

3 Set lens diaphragm ring index mark against the letter corresponding to existing or anticipated light conditions. The letters "B," "H," and "D," located on the lower part of the lens index ring, correspond to "BRIGHT," "HAZY," and "DULL," respectively.



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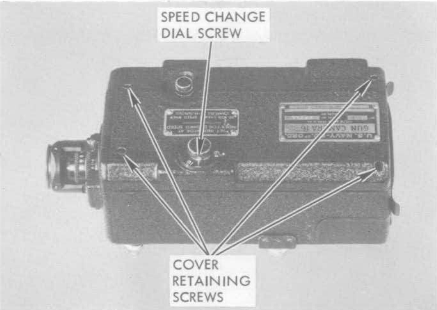
4 With diaphragm ring set to proper light condition, note which "f" number on the lower part of the diaphragm ring is aligned with index mark on lens barrel. Rotate diaphragm ring until the next lower "f" number is aligned with index mark.

Note Normally, when desired shutter speed and anticipated light condition settings have been made, the lens diaphragm ring will automatically be set to the correct diaphragm opening for that speed and light condition. However, use of the erector head requires that a wider lens setting be used to compensate for light loss. Therefore, when other settings have been made, the "f" number setting must be reduced by one "f" number. The following diaphragm openings are correct for the indicated light conditions and shutter speeds on the 35 mm F3.5 lens when an erector head is used.

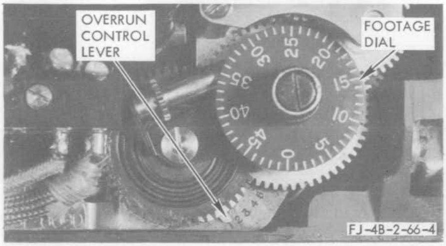
SHUTTER SPEED	BRIGHT	HAZY	DULL
64	f5.6	f4	f3.5
32	f8	f5.6	f4
16	f11	f8	f5.6

5 If not previously set, set desired camera overrun period. To set overrun period, remove setscrew in shutter speed knob and remove knob from camera.

6 Remove four cover retaining screws on corners of cover and remove cover from camera.



7 Set overrun control lever to desired number (1 to 5) indicated on overrun control plate. Overrun period may be set for 1 to 5 seconds in one second increments.



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8 Replace cover and cover retaining screws.

9 Replace shutter speed knob and setscrew.

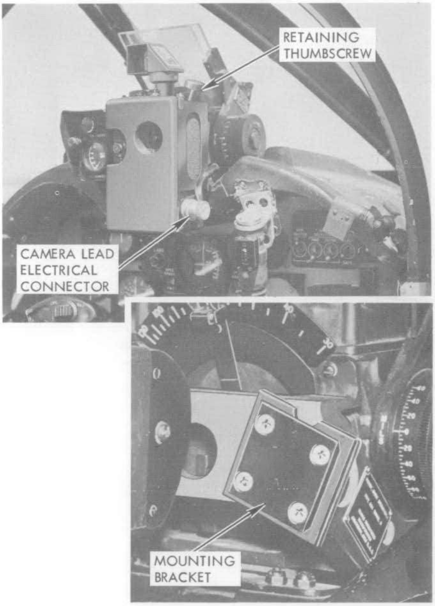
REMOVING

1 Disconnect electrical connector plug from camera electrical socket.

2 Loosen camera retaining thumbscrew sufficiently to allow camera to slip off mounting bracket.

3 Lift camera free of mounting bracket and remove from airplane.

INSTALLING



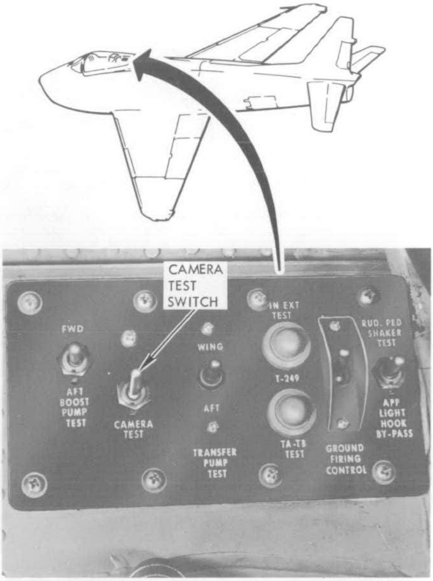
1 Loosen camera retaining thumbscrew on mount sufficiently to allow camera to slip on mounting bracket.

2 Engage camera mount with camera mounting bracket on gun sight head. Place camera in mounted position and tighten thumbscrew to retain camera in position.

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3 Connect camera lead electrical connector to socket in camera.

Note With electrical power on the airplane secondary bus, the camera may be test operated by engaging purge valve and camera test circuit breaker and depressing camera test switch on canopy deck test switch panel.



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EXTERNAL STORES

7-131. EXTERNAL STORES.

7-132. The installation of equipment contained in the various packages (209-63202) prepares the airplane's six wing stations for receiving a variety of external stores. With the appropriate equipment installed, capabilities are as follows: rockets at all stations, except Aero 10 pod not carried inboard; bombs up to 500 pounds at all stations; bombs over 500 pounds at mid stations only; fuel tanks at all stations, except inboard; missiles at all stations; and special weapons at station 2 only. Most combinations are possible as long as opposite wing stations are in balance. Inboard stations are restricted because of limited space. Package equipment includes the necessary adapter beams, Bullpup pylons, fuel tank pylons, universal pylons and a special weapon pylon to equip the airplane to carry external stores.

Note

The Aero 15B or Aero 15C bomb-rocket racks, Sidewinder pylons and launchers used in conjunction with the various external stores packages (209-63202) are government furnished.

CAUTION

The external stores emergency release circuit breaker should be disengaged when the airplane is on the ground, to prevent unintentional jettisoning of external stores.

External store system electrical wiring is installed in the airplane and terminates at connector plugs under the wing at each external store station. (See figure 7-22.) When external store equipment is not installed on the airplane, the electrical wiring, extending below the wing at each station, is enclosed in fairings which attach to the underside of the wing. An external stores control box is installed in the center pedestal. Provisions are incorporated in the pedestal for the additional installation of special system control boxes, furnished in the external stores packages. {Refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).}

7-133. EXTERNAL STORE ADAPTER BEAMS.

7-134. Included with the package equipment are six external store adapter beams. When installed at the six underwing external store stations, the adapter beams will accommodate Aero 15B or Aero 15C bomb-rocket racks for bomb and rocket installations, pylons with Aero 5A launchers for the Bullpup or Aero 3A pylons and launchers for Sidewinder installations. In addition, the adapter beams at stations 2 and 5 will accommodate the 200-gallon Type II auxiliary fuel tanks. The adapter beams are mounted to the undersurface of the wing by means of internal wrenching head mount bolts. Electrical wiring from the adapter beams is connected to the external stores system electrical connectors below the wing at the rear spar. The adapter beams provide mount points and electrical connector plugs to accommodate Aero 15B bomb-rocket racks or missile pylons and launchers. The adapter beams at stations 2 and 5 incorporate a mechanical release which is used to drop the 200-gallon auxiliary fuel tanks. An actuating plunger extends through a hole provided in the wing leading edge to contact the mechanical release slide, housed in the wing forward spar. For installation and removal procedures for external store adapter beams, refer to paragraphs 7-149, 7-150 and 7-151.

7-135. AUXILIARY FUEL TANK PYLONS.

7-136. Two auxiliary fuel tank pylons, incorporating Aero 7A ejector bomb racks, are provided for installation at stations 1 and 6. When installed at stations 1 and 6, the pylons will accommodate the Aero 1A 150-gallon auxiliary fuel tanks. For installation and removal procedures for auxiliary fuel tank pylons, refer to paragraph 7-154. For further information concerning auxiliary fuel tank pylons, refer to paragraphs 4-267 and 4-273 and see figure 4-75.

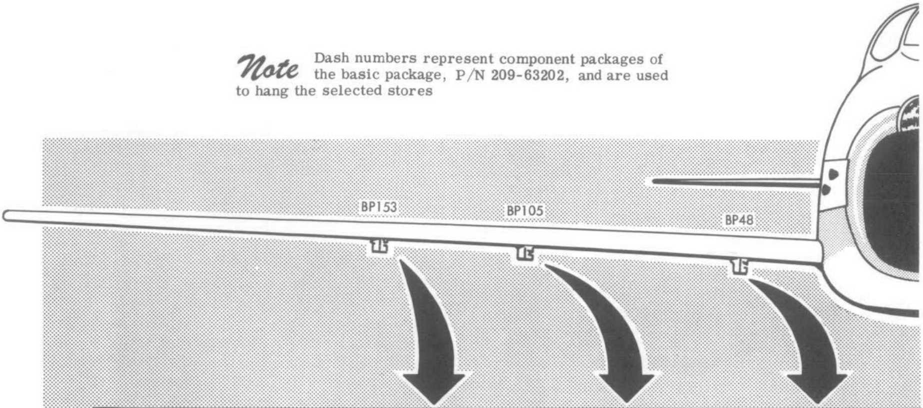
7-137. UNIVERSAL PYLONS.

7-138. Universal pylons, incorporating Aero 7A ejector bomb racks, are provided for installation at stations 2 and 5. When installed on the airplane, the universal pylons equip stations 2 and 5 to carry either 1000- or 2000-pound bombs and Aero 14 spray tanks. In addition, the installation of the universal pylon at station 2 equips that station to carry a Mark 12, Mark 28, Mark 105 or TX43 store. {Refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).} The Aero 7A bomb rack, utilized in the universal pylons, is a four-hook rack incorporating sway braces and a telescoping piston-type ejector. The bomb rack ejector is equipped with provisions for two Mark 2 Mod 0 or Mark 2 Mod 1 cartridges, one in the normal firing circuit and one in the jettison firing circuit. Both primers detonate from either firing source. Provided in the aft end of the universal pylon at station 2 are store fuse and relay boxes and the necessary store electrical connector plugs. Electrical wiring from the pylons connects to the external stores system electrical wiring, emerging from the wing at the rear spar. For installation and removal procedures for universal pylons, refer to paragraph 7-155.

7-139. MARK 7 STORE PYLON.

7-140. A pylon capable of accommodating a Mark 7 store is provided for installation at station 2. The pylon has provisions for an Aero 7A ejector bomb rack, a store fuse and relay box and the necessary store electrical connectors. Electrical wiring from the pylon connects to the external stores system electrical wiring, emerging from the wing at the rear spar. For installation and removal procedures for Mark 7 store pylon, refer to paragraph 7-156.

Note Dash numbers represent component packages of the basic package, P/N 209-63202, and are used to hang the selected stores



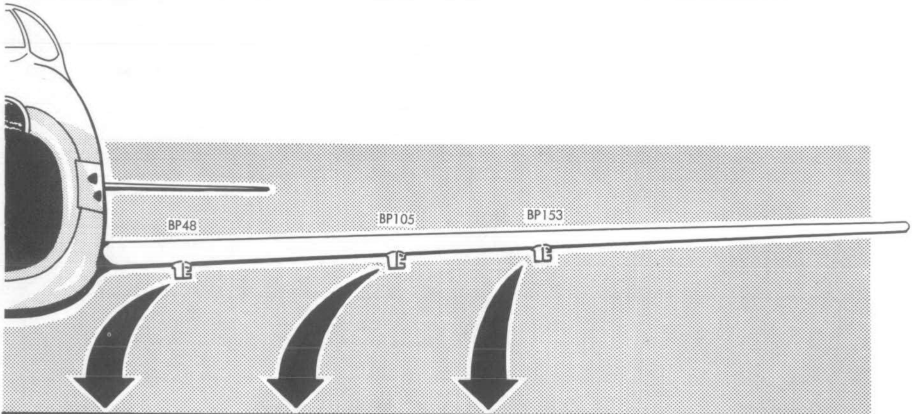
CAPABILITIES		STATION 6 (OUTBOARD)	STATION 5 (MIDSTATION)	STATION 4 (INBOARD)
BOMBS UP TO 500 POUNDS		-61	-51 OR -151	-11 OR -111
BOMBS OVER 500 POUNDS			-21 OR -121	
ROCKETS		-61	-51 OR -151	-11 OR -111
SIDEWINDER		{ -61 -81	{ -51 OR -151 -81	{ -11 OR -111 -81
BULLPUP * [1]		{ -61 -71	{ -51 OR -151 -71	{ -111 -71
STORES	MK 12 OR MK 28			
	MK 7			
AUXILIARY FUEL TANKS	150-GALLON	-41		
	200-GALLON		-51 OR -151	
BUDDY TANK			-21 OR -121	

* For further information, refer to Supplemental Handbook of Maintenance Instructions, NAVAER 01-60JKE-502A

[1] Airplanes 143493k through 143643m and subsequent

FJ-4B-2-63-54A

Figure No. 7-21. External Stores Package—P/N 209-63202 (Sheet 1)



STATION 3 (INBOARD)	STATION 2 (MIDSTATION)	STATION 1 (OUTBOARD)	CAPABILITIES
-11 OR -111	-51 OR -151	-61	BOMBS UP TO 500 POUNDS
	-21 OR -121		BOMBS OVER 500 POUNDS
-11 OR -111	-51 OR -151	-61	ROCKETS
-11 OR -111 } -81	-51 OR -151 } -81	-61 } -81	SIDEWINDER
-111 } -71	-51 OR -151 } -71	-61 } -71	BULLPUP * [1]
	-21 OR -121		MK 12 OR MK 28 } STORES
	-31 AND AERO 7A RACK		MK 7 } STORES
		-41	150-GALLON } AUXILIARY FUEL TANKS
	-51 OR -151		200-GALLON } AUXILIARY FUEL TANKS
	-21 OR -121		BUDDY TANK

* For further information, refer to Supplemental Handbook of Maintenance Instructions, NAVAER 01-60JKE-502A

[1] Airplanes 143493k through 143643m and subsequent

FJ-4B-2-63-55A

Figure No. 7-21. External Stores Package—P/N 209-63202 (Sheet 2)

ARMAMENT PACKAGES OF BASIC PACKAGE 209-63202	STATION 6	STATION 5	STATION 4
-11 [2]			ADAPTER BEAM 209-63210-2 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***
-111			ADAPTER BEAM 209-63210-102 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***
-21		UNIVERSAL PYLON 209-63413-2	
-121		UNIVERSAL PYLON 209-63413-2	
-31			
-41	150-GAL TANK PYLON 209-63212-2		
-51		ADAPTER BEAM 209-63513-2 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***	
-151		ADAPTER BEAM 209-63513-32 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***	
-61	ADAPTER BEAM 209-63312-2 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***		
-71	PYLON 209-68212-2	PYLON 209-68213-2	CONTROL POD 209-68214
-81	PYLON AND LAUNCHER AERO 3A***	PYLON AND LAUNCHER AERO 3A***	PYLON AND LAUNCHER AERO 3A***

*** Government Furnished and Government Installed

[2] Cannot be used for Bullpup Missile

FJ-4B-2-63-56C

Figure No. 7-21. External Stores Package—P/N 209-63202 (Sheet 3)

STATION 3	STATION 2	STATION 1	ARMAMENT PACKAGES OF BASIC PACKAGE 209-63202
ADAPTER BEAM 209-63210-1 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***			-11 [2]
ADAPTER BEAM 209-63210-1 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***			-111
	UNIVERSAL PYLON 209-63413-1 [3] 209-63413-71 [4]		-21
	UNIVERSAL PYLON 209-63413-71		-121
	MK 7 STORE PYLON 209-63313		-31
		150-GAL TANK PYLON 209-63212-1	-41
	ADAPTER BEAM 209-63513-1 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***		-51
	ADAPTER BEAM 209-63513-31 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***		-151
		ADAPTER BEAM 209-63312-1 BOMB-ROCKET RACK AERO 15B OR AERO 15C ***	-61
PYLON 209-68210-1	PYLON 209-68213-1	PYLON 209-68212-1	-71
PYLON AND LAUNCHER AERO 3A***	PYLON AND LAUNCHER AERO 3A***	PYLON AND LAUNCHER AERO 3A***	-81

*** GOVERNMENT FURNISHED AND GOVERNMENT INSTALLED

[2] CANNOT BE USED FOR BULLPUP MISSILE

[3] PACKAGE NO. H001 THROUGH H071 NOT HAVING SERVICE CHANGE NO. 482 COMPLIED WITH

[4] PACKAGE NO. H001 THROUGH H071 HAVING SERVICE CHANGE NO. 482 COMPLIED WITH

FJ-4B-2-63-68C

Figure No. 7-21. External Stores Package—P/N 209-63202 (Sheet 4)

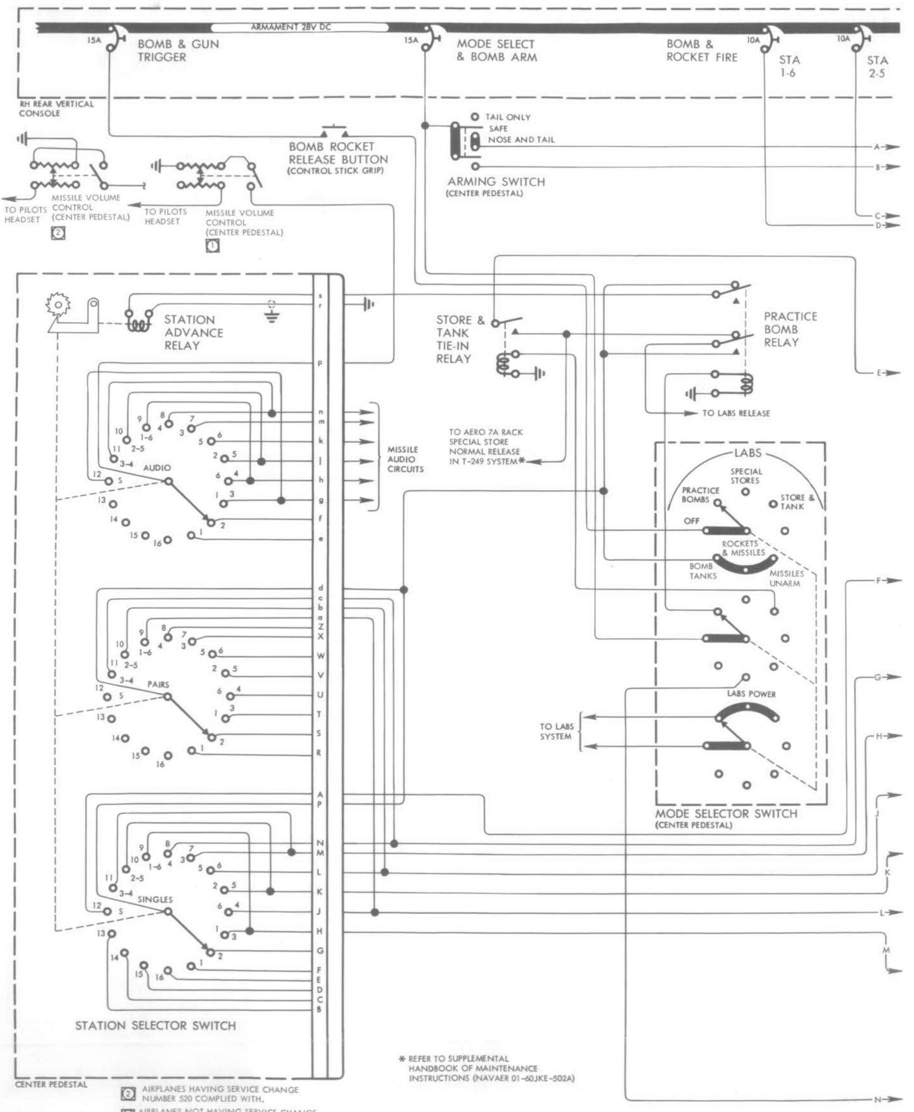
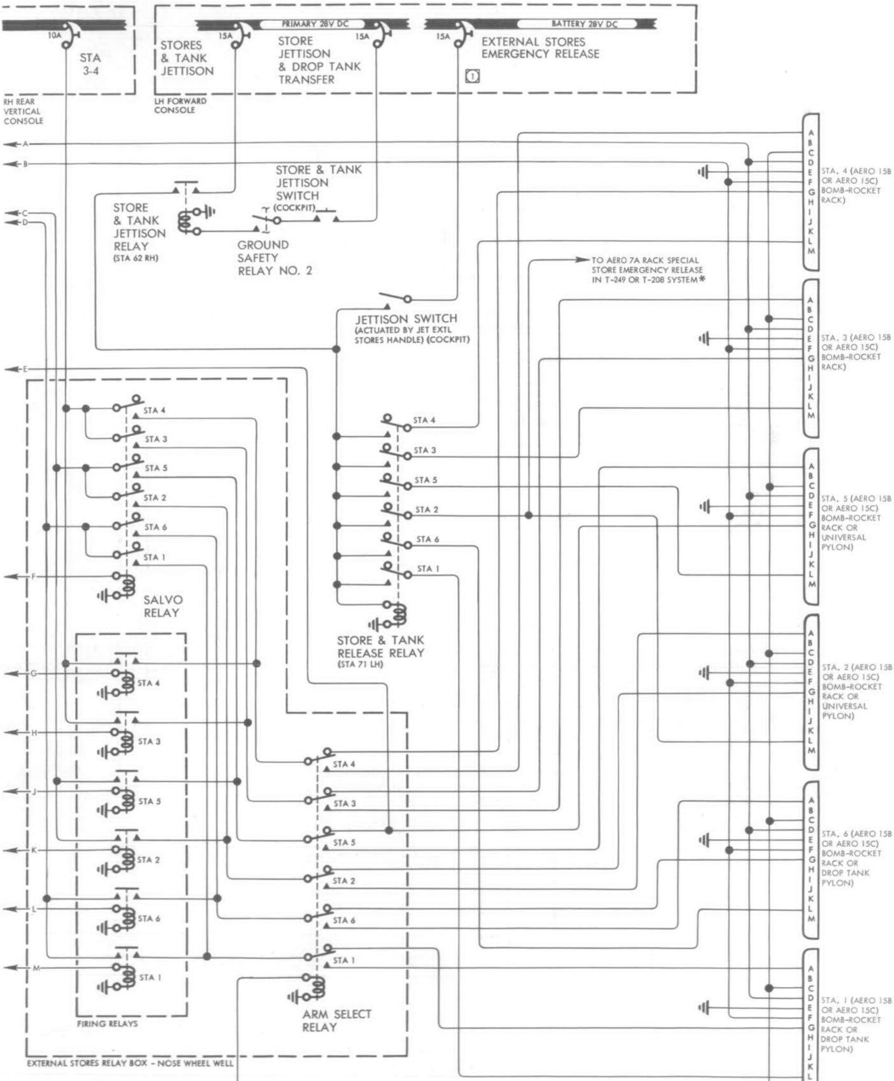


Figure No. 7-22. Bomb and Rocket System and External Stores Release (Sheet 1)



1 THE EXTERNAL STORES EMERGENCY RELEASE CIRCUIT BREAKER SHOULD BE DISENGAGED, WHEN THE AIRPLANE IS ON THE GROUND, TO PREVENT UNINTENTIONAL JETTISONING OF EXTERNAL STORES.

FJ-4B-2-63-58C

Figure No. 7-22. Bomb and Rocket System and External Stores Release (Sheet 2)

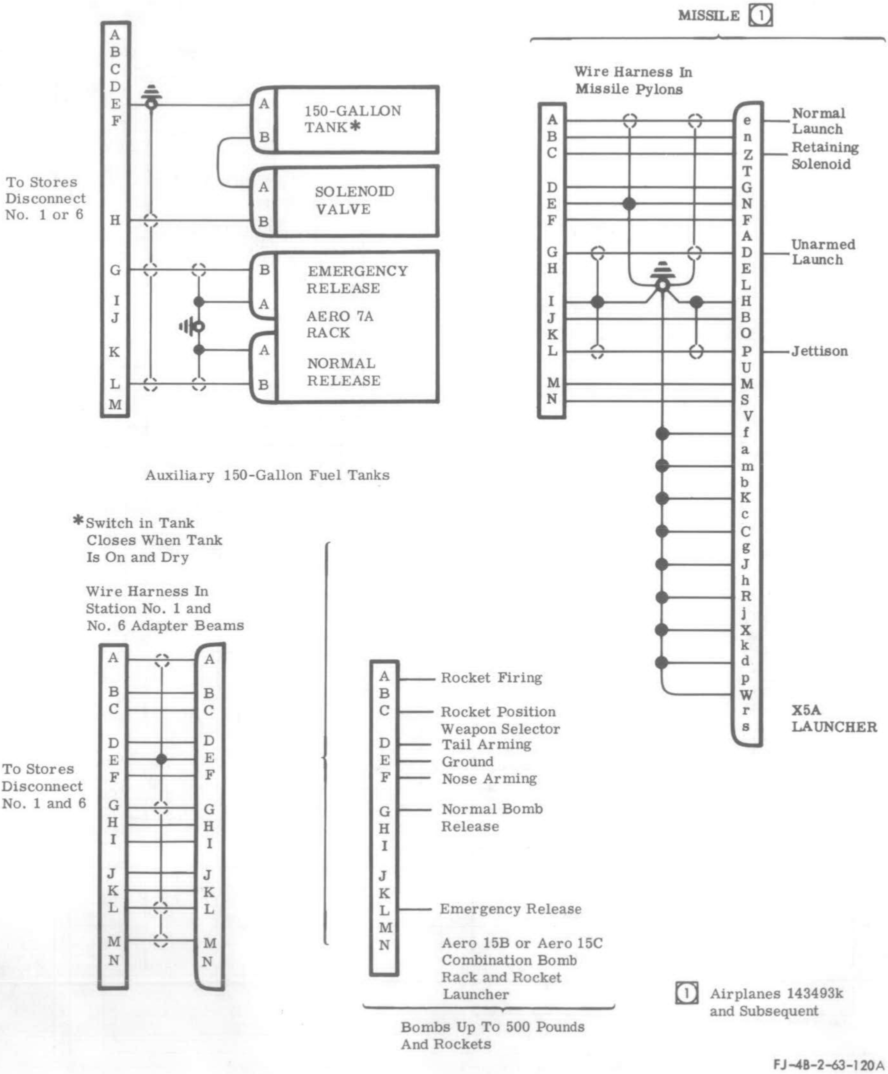


Figure No. 7-22. Bomb and Rocket System and External Stores Release (Sheet 3)

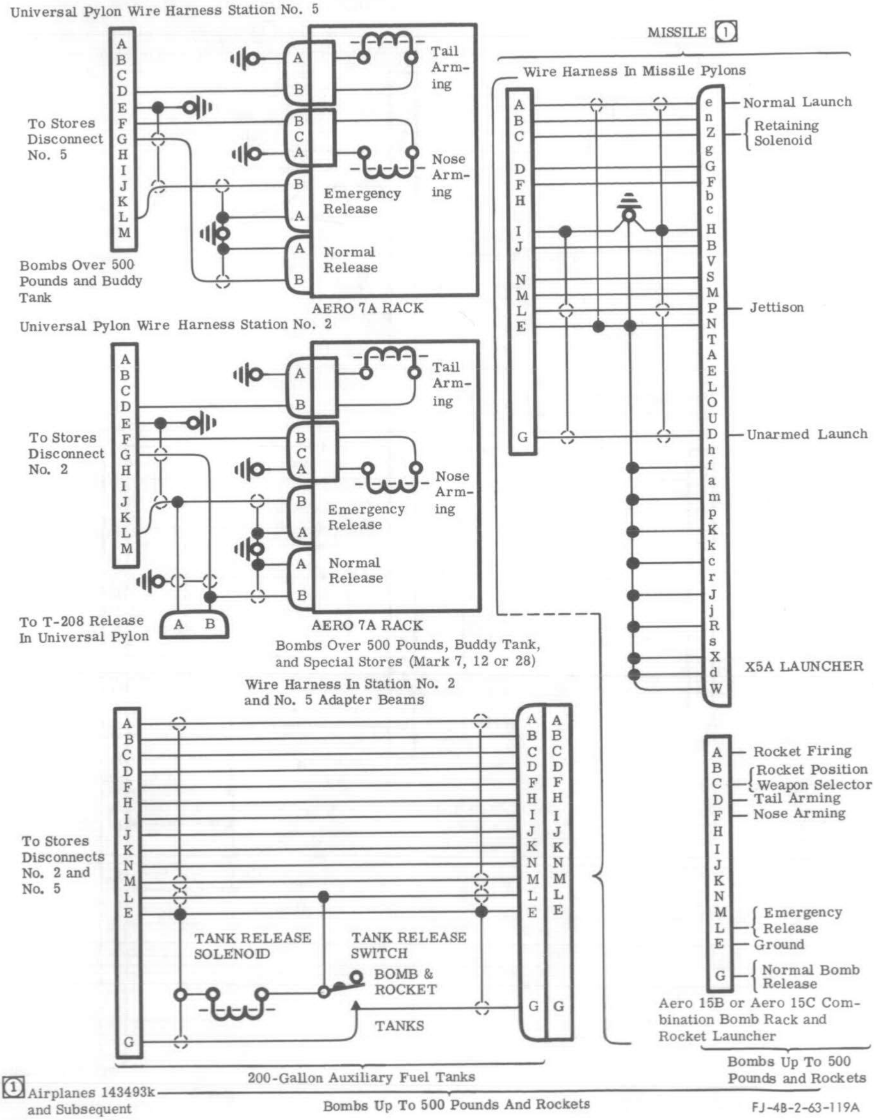


Figure No. 7-22. Bomb and Rocket System and External Stores Release (Sheet 4)

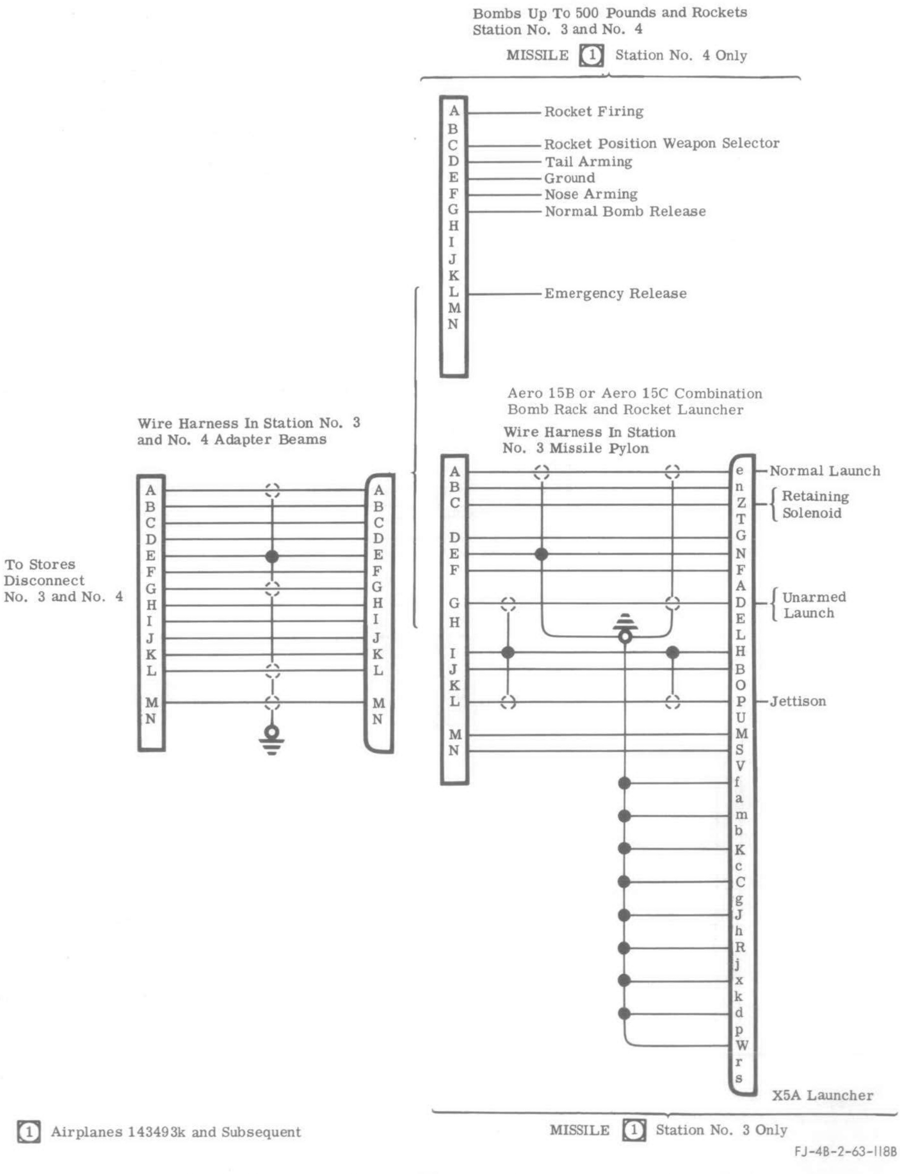


Figure No. 7-22. Bomb and Rocket System and External Stores Release (Sheet 5)

7-141. AERO 15B OR AERO 15C BOMB RACK AND ROCKET LAUNCHER.

7-142. The Aero 15B or Aero 15C combination bomb rack and rocket launcher is used in conjunction with the adapter beams to support either bombs or rockets. Mounting points and electrical connectors on the underside of the adapter beams accommodate the Aero 15B or Aero 15C bomb-rocket rack. The double-hooked rack is a 28-volt d-c, electrically controlled unit composed of a frame and fairing, two rack hooks, an operating mechanism, an emergency jettison mechanism, provisions for mounting rockets or rocket pods and an electrical harness. Nose and tail bomb arming units are incorporated in the bottom of the rack. Arming wires are retained in an unarmed condition by spring-loaded balls. Four sway braces can be individually raised or lowered for bombs or rocket pods of various diameters, or the sway braces can be turned up out of the way for the launching of single rockets. The operating mechanism cocks and releases the carrying hook linkage and can be latched by rotating the latching handle on the side of the rack. Incorporated at the forward end of the rack are rocket contacts used with the rocket pod installations. These contacts may be positioned through two actuating screws on the side of the rack to make contact with the rocket pod striker plates. The electrical harness includes two arming solenoids and a rack release solenoid. The arming solenoids retain the arming wire loops, when energized, and allow the arming wire loops to be pulled free when de-energized. When energized, the release solenoid actuates the operating mechanism to open the rack hooks. Actuating either the STORE & TANK JETTISON switch or the JET EXTL STORES handle routes electrical power to the emergency jettison mechanism. An explosive charge contained in the emergency jettison mechanism (Mark 25 primer) separates the store from the Aero 15B or Aero 15C rack. For installation and removal procedures for Aero 15B or Aero 15C racks, refer to paragraph 7-152.

Note

- After each jettison from an Aero 15B or Aero 15C rack, a shear pin forward of the jettison mechanism is replaced with a standard AN470AD3-10 rivet.
- It is also necessary to replace plastic clip (55A82A132), "O" ring (AN6227-8), lead coil (55A82A150) and plunger (55A82B211) and jettison piston extractor (55A82C13), if required.

7-142A. AUXILIARY FUEL TANK RELEASE SYSTEMS.

7-142B. The auxiliary fuel tanks (including the buddy tanker) and all external stores may be jettisoned simultaneously from all underwing stations by either of two methods (figures 7-22A and 7-22B):

a. Depressing the STORE & TANK JETTISON button (located above the forward end of the left-hand console) will release electrically all auxiliary tanks and external stores.

b. Pulling the JET EXTL STORES handle (located on the forward end of the left-hand console) releases electrically all auxiliary fuel tanks and external stores and, in addition, will release mechanically the 200-gallon inboard auxiliary tanks.

c. The following methods may be used to jettison auxiliary fuel tanks when it is desired to retain the external stores carried at the other underwing stations.

d. To remove the 200-gallon tanks (paragraph 4-266) individually from outside the cockpit, insert a $3/8$-inch square drive extension wrench into the slot provided on the inboard side of the adapter beam. Turn the wrench counterclockwise and tank will release.

e. To remove the 150-gallon tanks (paragraph 4-278) or buddy tanks (paragraph 4-298) (both are hung on an Aero 7A bomb rack) individually from outside the cockpit, place a socket wrench on the manual release knob (left-hand forward side of rack) and turn counterclockwise and tank will release.

PROCEDURE TO RELEASE TANK OR TANKS	AUXILIARY FUEL TANK INSTALLATION
Position MODE SELECT switch on external stores control box to "BOMBS & TANKS," position STATION SELECTOR switch to "2," then "5" (to drop tanks individually), or to "2-5" (to drop tanks together) and depress bomb-rocket release button.	Two 200-gallon Type II auxiliary fuel tanks or two buddy tanks.
Position MODE SELECT switch on external stores control box to "BOMBS & TANKS," position STATION SELECTOR switch to "5" and depress bomb-rocket release button.	One 200-gallon Type II auxiliary fuel tank at right-hand intermediate station.
Position MODE SELECT switch on external stores control box to "BOMBS & TANKS," position STATION SELECTOR switch to "1," then "6" (to drop tanks individually), or to "1-6" (to drop tanks together) and depress bomb-rocket release button.	Two 150-gallon auxiliary fuel tanks.

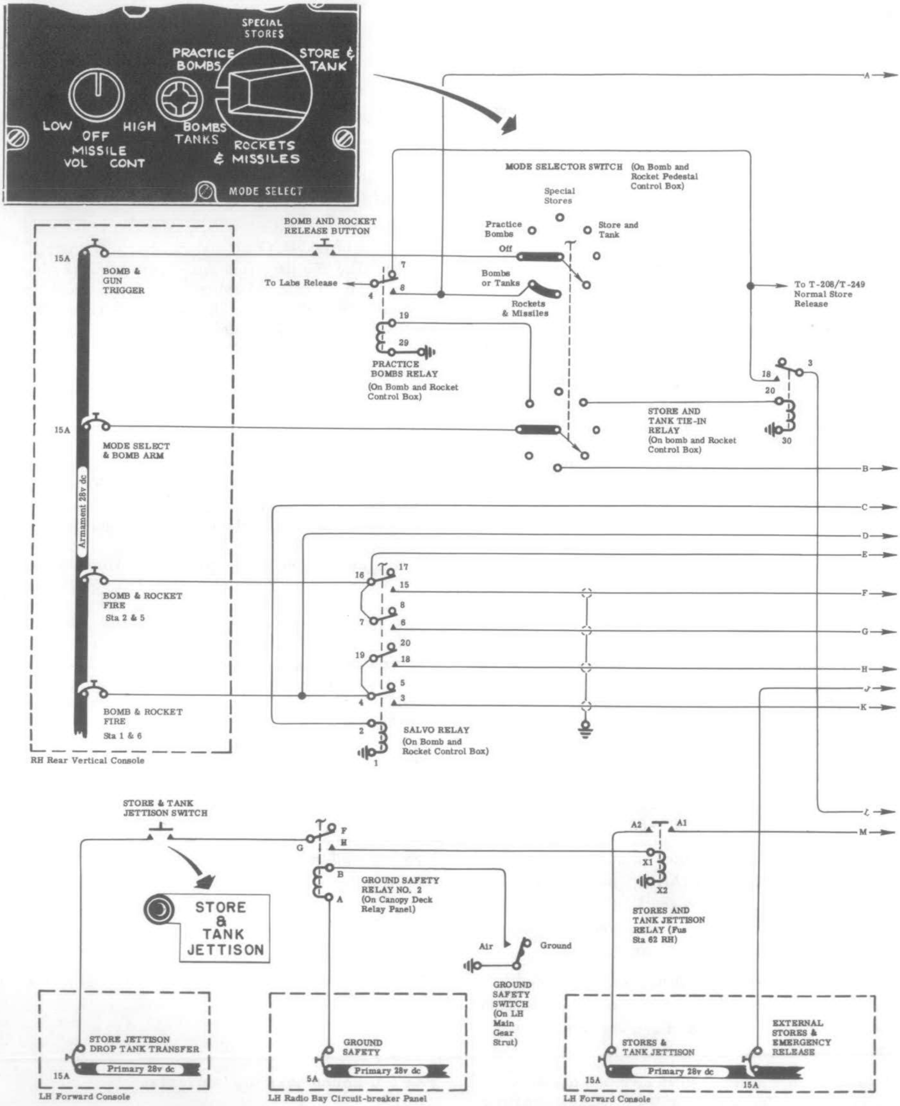
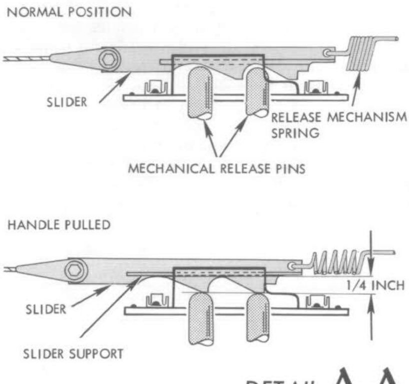


Figure No. 7-22A. Auxiliary Fuel Tank Release Systems (Sheet 1)

3 When handle is pulled to full out position with pylon installed, the travel of mechanical release pins should be 1/4 inch.

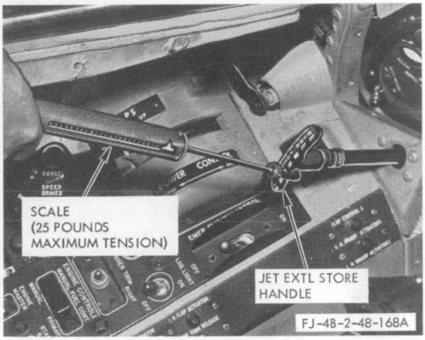


DETAIL **A-A**

4 Operate several times and re-check above steps.

5 Safety turnbuckles with AN995F41 lockwire.

6 Maximum load on handle to be 25 pounds.



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7-143. SIDEWINDER PYLON AND LAUNCHER.

7-144. An Aero 3A Sidewinder pylon and launcher can be installed at each of the six external store stations. The appropriate adapter beam must be installed at the external store station before the pylon and launcher can be installed. The adapter beam provides mounting points and electrical connections to accommodate installation of the pylon. The pylon, in turn, provides mounting points and electrical connections for the installation of the launcher. For installation and removal procedures for Sidewinder pylon and launcher, refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).

7-144A. BULLPUP MISSILE PYLON AND LAUNCHER AND CONTROL POD.

7-144B. The Bullpup missile pylon and launcher is assembled as a single unit and is installed on wing stations 1, 2, 3, 5 and 6. Each pylon is faired to fit a particular station. Before the pylon is installed, the appropriate adapter beam must be installed at the wing station. The adapter beam provides mounting points and electrical connections to accommodate installation of the pylon. Station 3 adapter beam is modified to provide for the installation of an extra pylon mounting point. The Bullpup missile control pod is installed at wing station 4. It is installed on an Aero 15B or Aero 15C combination bomb rack and rocket launcher. A modified adapter beam is used which provides mounting points and electrical connections for the rack and electrical connections for the control pod. For installation and removal procedures for Bullpup missile pylon and launcher and Bullpup missile control pod, refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).

7-145. AERO 7A EJECTOR BOMB RACK.

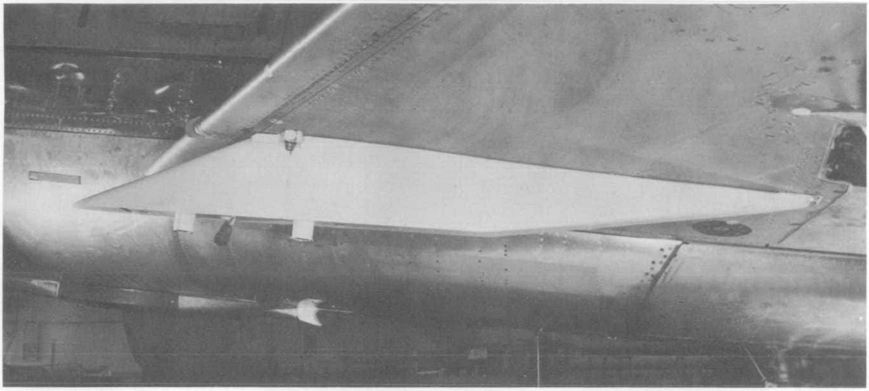
7-146. The universal pylons, the auxiliary fuel tank pylons and the Mark 7 store pylon have provisions for Aero 7A ejector bomb racks. The Aero 7A ejector bomb rack (figure 7-34) is a four-hook rack having one set of hooks 14 inches apart and a second set of hooks 30 inches apart. The bomb rack consists of a housing assembly equipped with a dual breech containing two Mark 25 Mod 0 primers for use at stations 1 and 6 or two Mark 2 Mod 0 or Mark 2 Mod 1 cartridges for use at stations 2 and 5, four tandem hooks, a piston and ejector foot assembly, mechanical linkage connecting the hook sears to the piston assembly and four individually adjustable sway braces. Breech chamber adapters are provided for the Mark 25 primers presently being used. The electrical release impulse detonates both primers. The resultant pressure generated by the detonation of the primers forces the ejector mechanism upward, raising each hook sear through mechanical linkage and thus opening the hooks. At the same time, pressure forces the ejector foot downward against the store, ejecting the store from the airplane. Arming solenoids are installed on the bomb rack and are used to retain the bomb arming wires when armed release of the bombs is desired. Sway-brace adjustment bolts above each sway brace provide a means for tightening the sway braces against the store which is carried. The bomb rack hooks may be opened manually for loading or other ground operations by rotating the release knob above the forward hook. Rotating the knob counterclockwise mechanically actuates the release linkage to raise the sears and open the hooks.

CAUTION

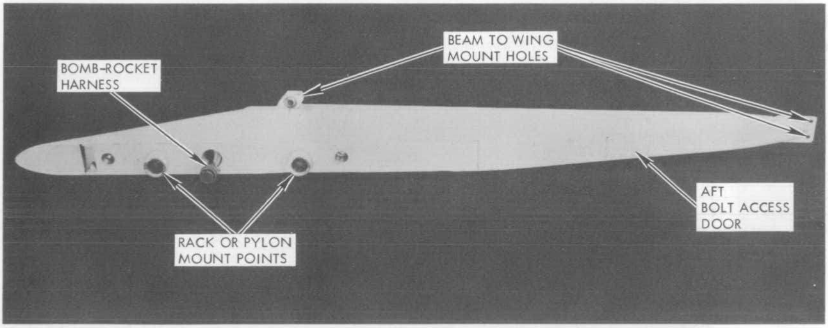
Do not operate the rack electrically with Mark 25 Mod 0 primers, Mark 2 Mod 0 cartridges or Mark 2 Mod 1 cartridges in breech chambers or without a store in the hooks.

7-147. BOMB AND ROCKET SYSTEM CONTROL BOX.

7-148. The bomb and rocket system control box (figure 7-32) includes the station selector switch (STATION SELECTOR), the mode selector switch (MODE SELECT) and the bomb arming switch (ARMING). The station selector switch can be set to release or fire the stores by single stations, by paired stations or all stations may be salvoed simultaneously. The mode selector switch can be set to the various positions to conform with the type of external stores carried. The ARMING switch can be set either to "NOSE & TAIL," "TAIL ONLY" or to "SAFE" position, arming the bombs accordingly. The bomb and rocket system control box incorporates an automatic station advance relay and mechanism. When stores are released or fired by single stations or by paired stations, the first station is selected manually. Thereafter, each time the bomb-rocket release button is depressed and released, the automatic station advance will move the station selector switch to the next station or pair of stations in order. The station advance will continue to move the station selector switch until all stores are released or fired. "SALVO" position must be selected manually.



STATIONS 3 AND 4 - BP 48



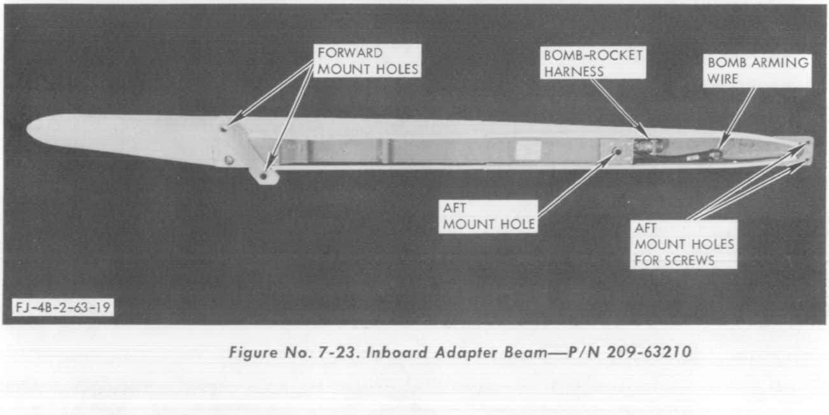


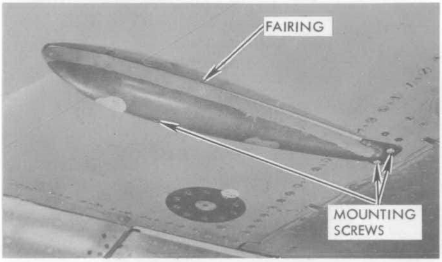
Figure No. 7-23. Inboard Adapter Beam—P/N 209-63210

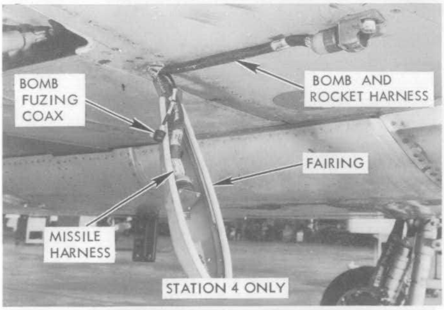
7-149. INSTALLING AND REMOVING INBOARD ADAPTER BEAMS (STATIONS 3 AND 4).

INSTALLING

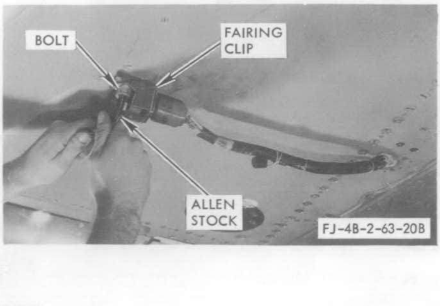
Note Station four adapter beam (209-63210-102) installation has one additional missile harness to be connected which is reflected in this procedure.

1 Remove electrical stowage fairing from undersurface of wing. (Any small parts to be further removed from this station can be placed in the stowage fairing, for reinstallation.)

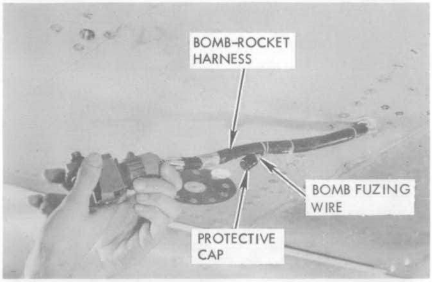


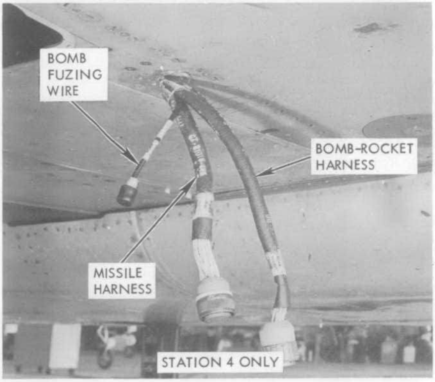


2 Remove safety wire fairing clip bolt, washer, clip, and seal from wing.



3 Unscrew fairing clip from bomb-rocket harness and remove protective cap from bomb arming wire.

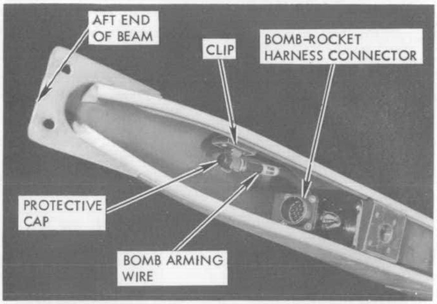


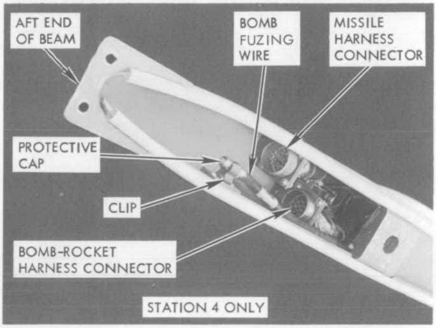


4 Remove plugs and "O" rings from the two forward mount points on undersurface of wing.

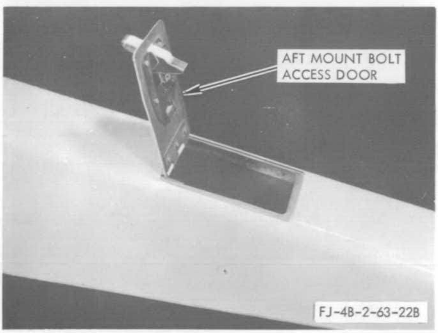


5 Pull bomb fuzing wire in adapter beam loose from spring clip and remove protective cap from end of wire.

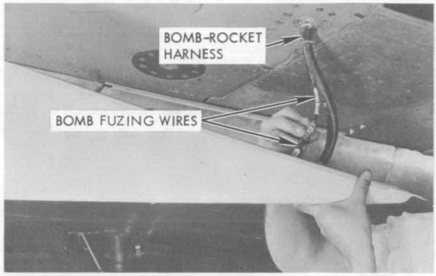


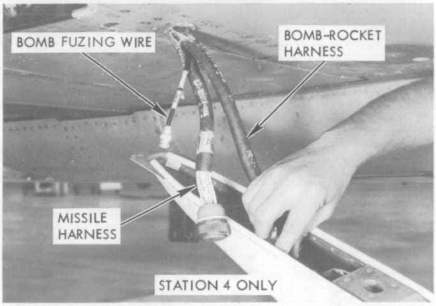


6 Open aft mounting bolt access door on underside of adapter beam.

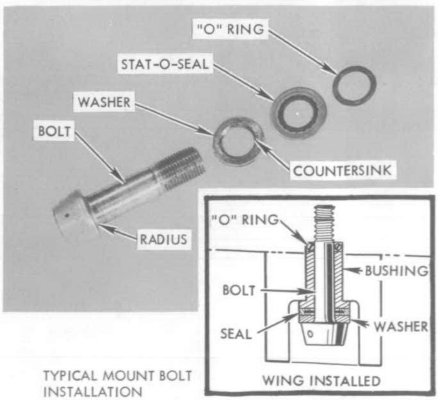


7 Raise adapter beam to mounting position and make electrical connections.





Note When installing adapter beam mounting bolts, place a fresh "O" ring in the wing bolt hole and fit countersunk washer between bolthead and Stat-O-Seal. Washer countersink must mate with radius under bolthead.

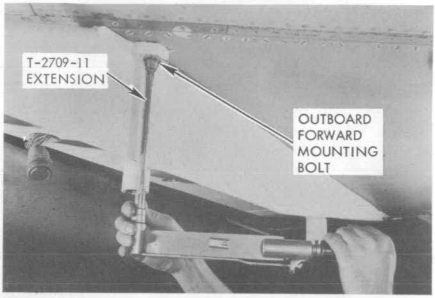


TYPICAL MOUNT BOLT INSTALLATION

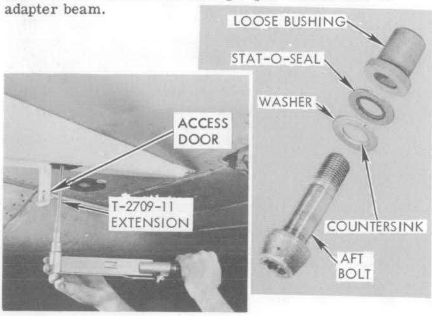
FJ-4B-2-63-124A

8 Install forward mounting bolts.

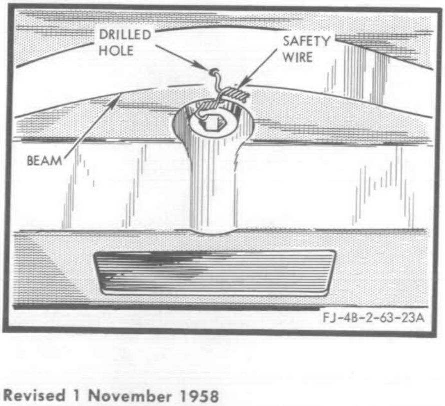
Note Do not allow weight of adapter beam to be supported by mounting bolts until all mounting bolts are drawn up tight.



9 Slip washer, Stat-O-Seal and loose bushing onto aft bolt and install bolt through open access door in adapter beam.

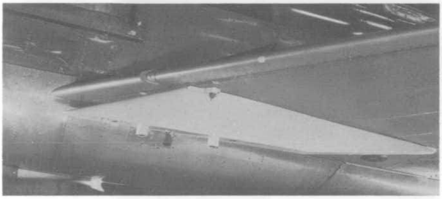


10 Torque all three mounting bolts to 120 foot-pounds and safety-wire bolts to holes drilled in beam with AN995F41 wire.



11 Close aft bolt access door and install two screws at aft end of adapter beam.





REMOVING

1 Make certain that electrical power has been removed from airplane.

2 Remove two screws at aft end of adapter beam and open aft bolt access door.

3 Support beam and remove aft and forward mounting bolts.

4 Disconnect electrical harnesses at aft end of beam.

5 Cover end of bomb fuzing wires with protective caps. Snap adapter beam fuzing wire into spring clip in beam.

6 Replace plugs, and "o" rings at the two forward mount points on undersurface of wing.

7 Install fairing clip and seal at aft bolt mounting point; install bolt and washer and torque to 100 inch pounds. Safety-wire clip bolt and attach electrical harness to stowage receptacles.

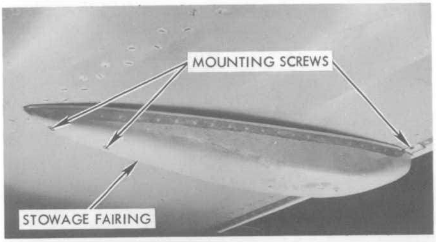
8 Enclose electrical wiring by mounting stowage fairing to undersurface of wing.

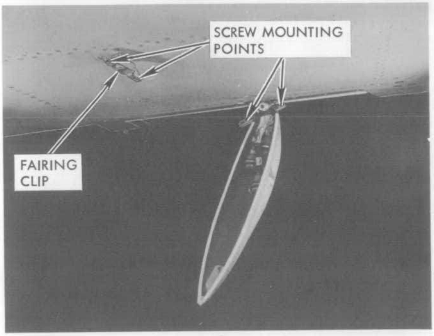
FJ-4B-2-63-24A

7-150. INSTALLING AND REMOVING MID STATION ADAPTER BEAMS (STATIONS 2 AND 5).

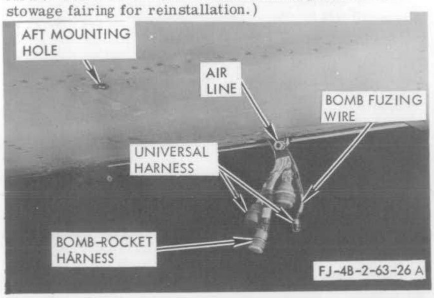
INSTALLING

1 Remove four screws from electrical stowage fairing. Fairing will swing down from undersurface of wing.



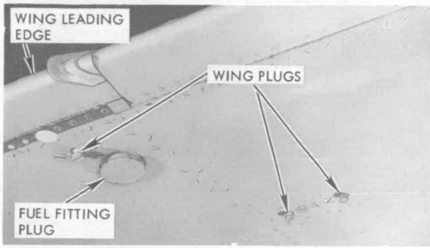


2 Remove fairing clip and seal from wing, by removing bolt and detach stowage fairing from wiring by breaking safety wires and loosening clamps holding wiring harnesses. (Any small parts to be further removed from this station can be placed in the stowage fairing for reinstallation.)

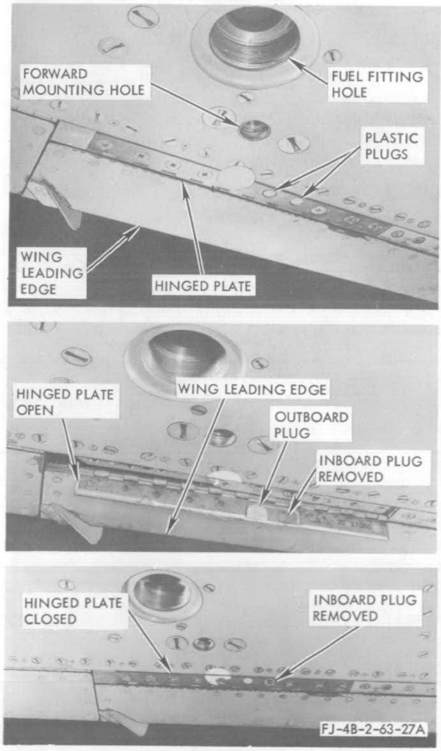


FJ-4B-2-63-26 A

3 Remove wing plugs and "O" rings from under surface of wing at forward mounting points. Use special tool, T-2707 to remove the fuel fitting plug. (See figure 7-30.)

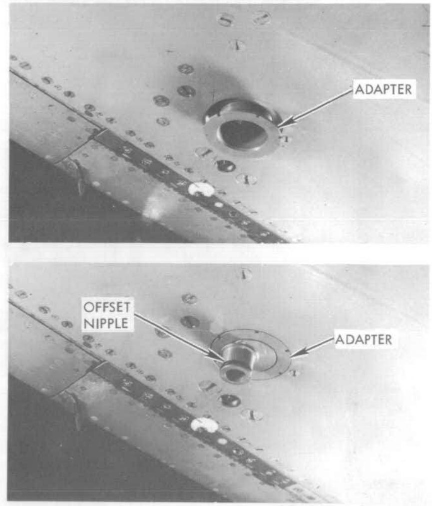


4 Remove screws from hinged plate on underside of wing leading edge; swing plate down; remove inboard plastic plug; close and secure plate to its original position.

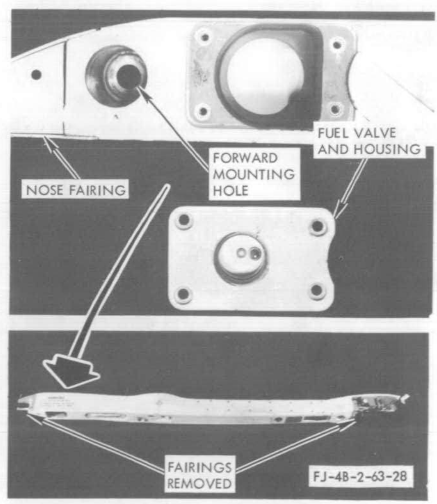


FJ-4B-2-63-27A

5 Install adapter, offset nipple and "O" rings into wing fuel fitting.

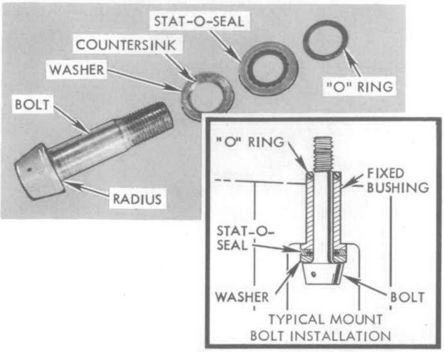


6 Remove fuel valve and housing, nose fairing and aft fairing from adapter beam.

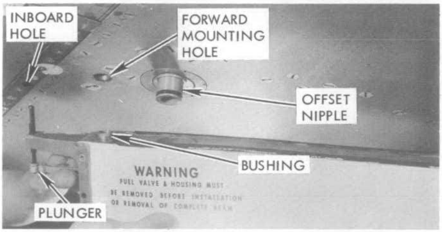


FJ-4B-2-63-28

Note When installing adapter beam mounting bolts, place a fresh "O" ring in wing bolt hole and fit countersunk washer between bolthead and Stat-O-Seal. Washer countersink must mate with radius under head of bolt.

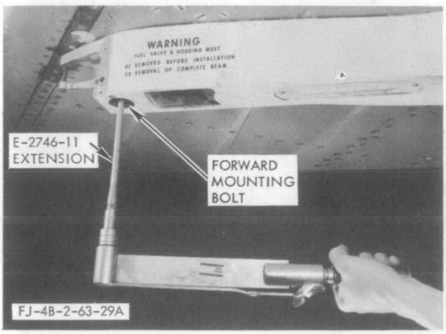


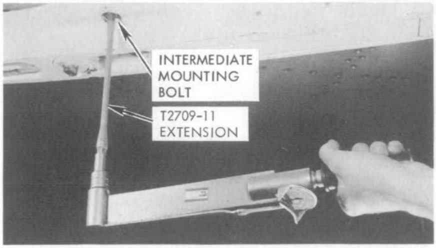
7 Raise adapter beam to wing, guiding emergency jettison plunger, bushings and offset nipple into appropriate holes.



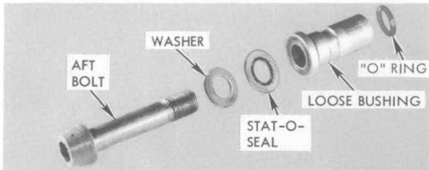
8 Install mounting bolts.

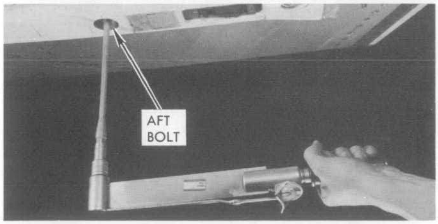
Note Do not allow weight of beam to be supported by mount bolts until all bolts are drawn up tight.



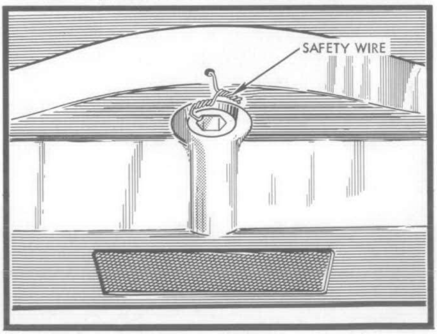


9 Slip washer, Stat-O-Seal and loose bushing onto aft bolt and install.



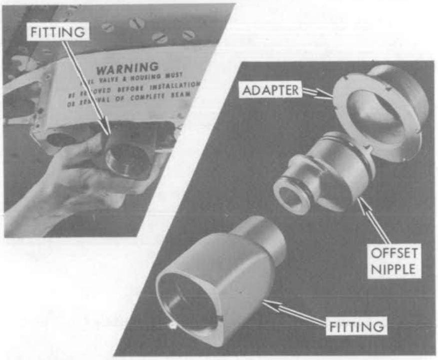


10 Apply 180 foot-pounds of torque to front mounting bolt and 120 foot-pounds to remaining three mounting bolts. Safety-wire two intermediate bolts through hole drilled in adapter beam with AN995F41 wire.



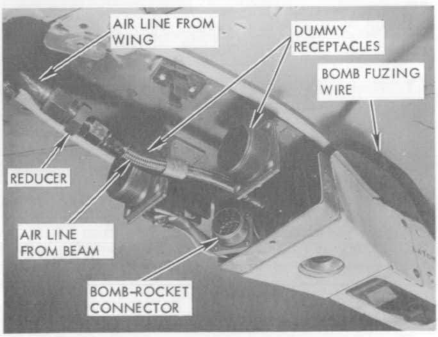
FJ-4B-2-63-30B

11 Install offset nipple fitting and replace fuel valve and housing in adapter beam.



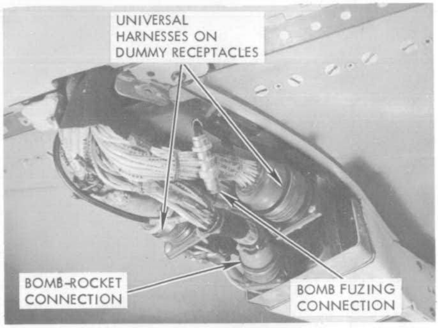


12 Insert reducer (AN919-12D) into air line from wing and connect to air line in adapter beam.

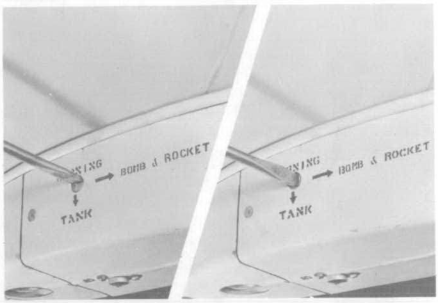


13 Connect bomb-rocket harness to bomb-rocket connector in beam. Attach two remaining harnesses to appropriate dummy receptacles and connect bomb fuzing wires.

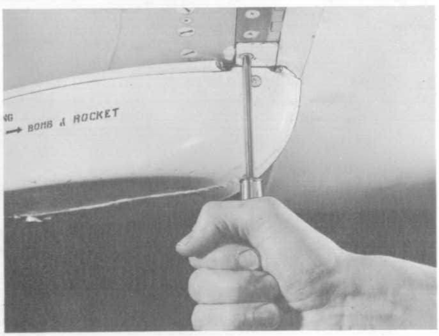
FJ-4B-2-63-31B



14 Install aft fairing on beam and position microswitch to conform with external stores to be carried.

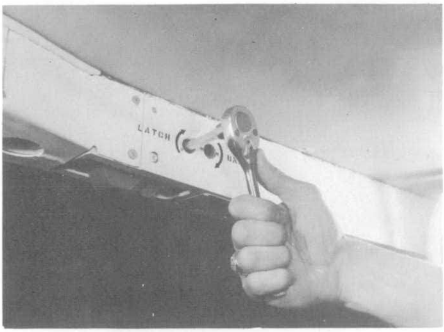


15 Install two screws through ears at aft end of adapter beam.

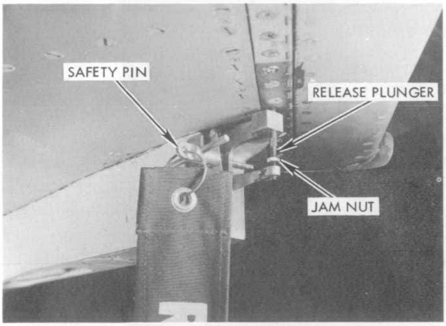


16 Latch drop tank release mechanism by inserting a 3/8 square drive tool in latch fitting and rotating in direction indicated.

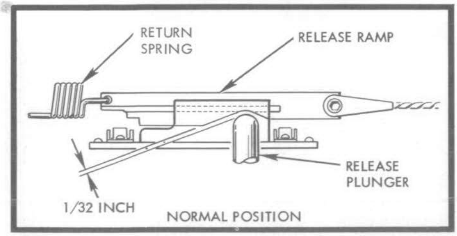
FJ-4B-2-63-32 A



17 Insert ground lock safety pin E3764 through holes in emergency jettison release linkage and adapter beam forging and loosen jam nut at base of release plunger.



18 Screw release plunger up into wing until snug, then back plunger down one full turn. This will leave approximately 1/32-inch clearance between plunger tip and cam surface of release ramp.



19 After adjustment is made, tighten jam nut, remove safety pin and replace nose fairing.

FJ-4B-2-63-33A



REMOVING

1 Make certain electrical power is removed from airplane.

2 Remove two screws at aft end of beam and remove nose.

3 Disconnect electrical wiring from beam.

4 Disconnect air lines and remove reducer.

5 Remove fuel valve and housing and offset nipple fitting from forward underside of adapter beam.

6 Remove four mounting bolts and loose bushing with aft bolt.

7 Remove beam from wing. Replace nose and aft fairings, fuel valve and housing.

8 Remove offset nipple and adapter from wing fuel fitting.

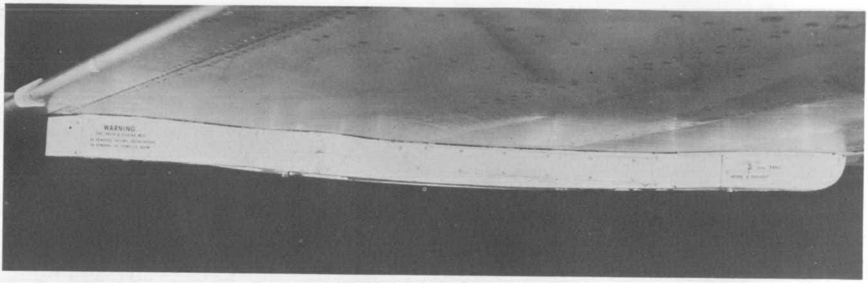
9 On underside of wing at leading edge, swing hinged plate down, replace inboard plastic plug and secure hinged plate back to original position.

10 Install, seal, stowage fairing clip, washer and bolt to wing at aft mount hole. Torque bolt to 100 inch-pounds and safety-wire to clip.

11 Clamp and safety-wire wiring harnesses to inside of stowage fairing.

12 Raise stowage fairing to undersurface of wing and fasten with four screws.

FJ-4B-2-63-40A



STATIONS 2 AND 5 - BP 105

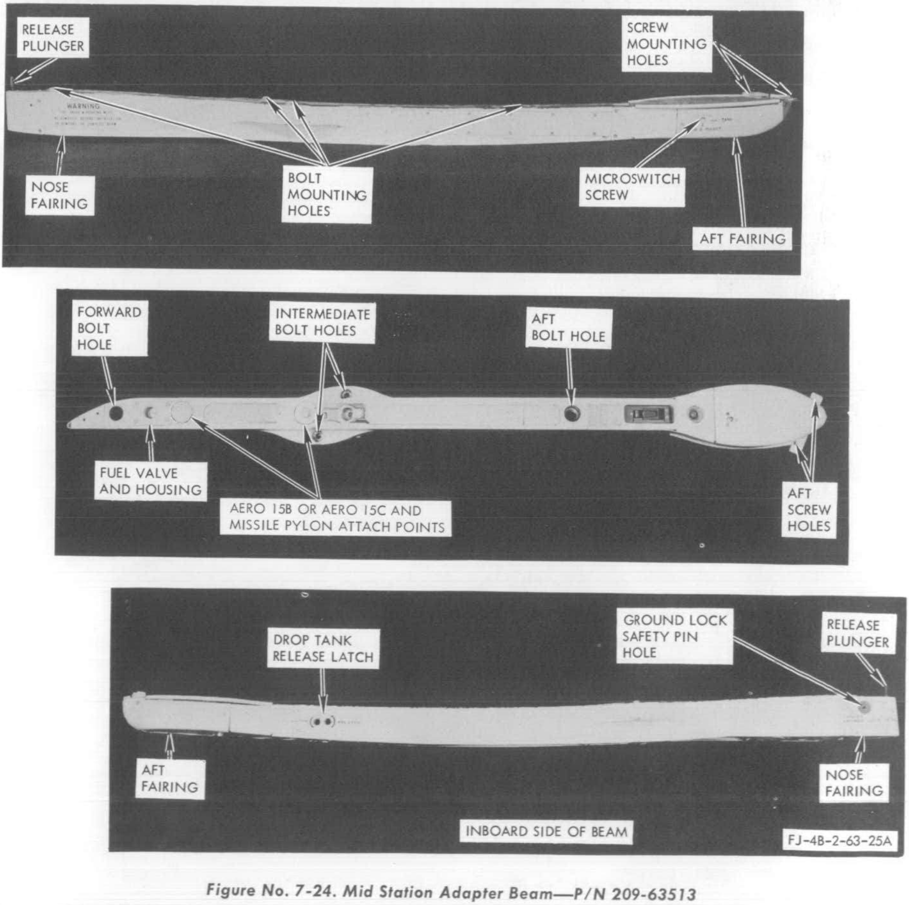
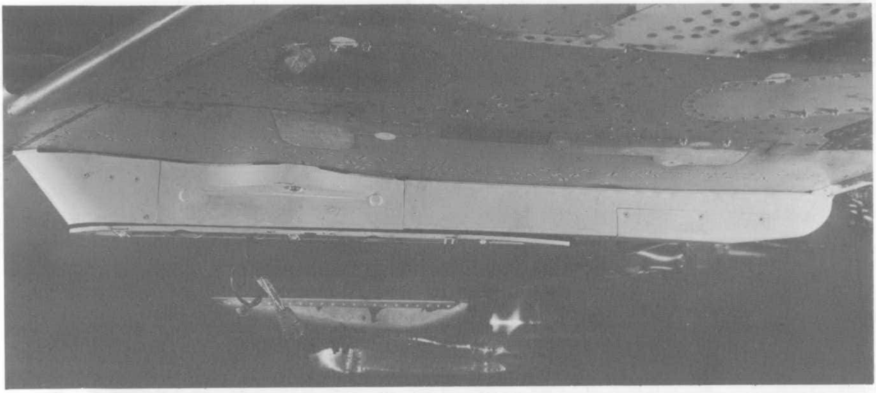
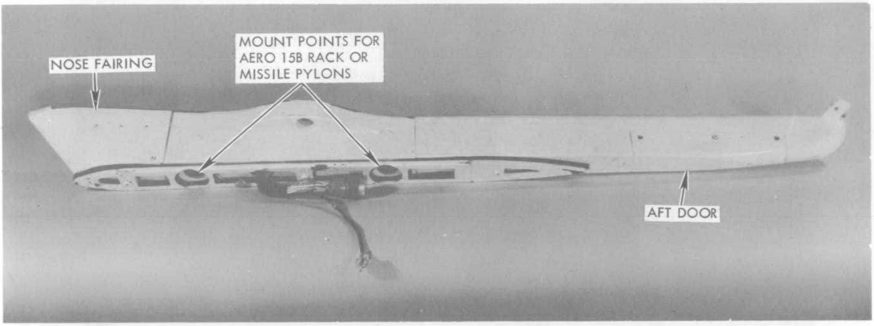


Figure No. 7-24. Mid Station Adapter Beam—P/N 209-63513



STATIONS 1 AND 6 - BP 153



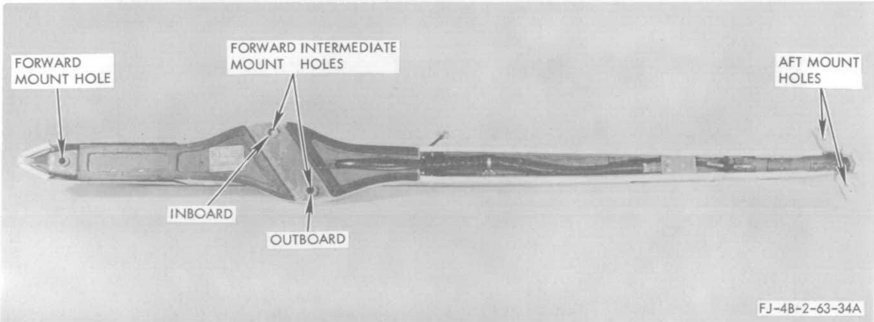
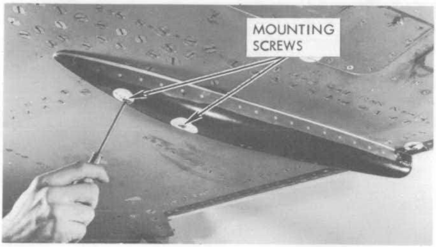


Figure No. 7-25. Outboard Adapter Beam—P/N 209-63312

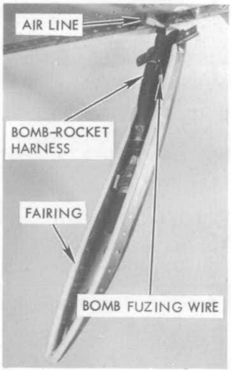
7-151. INSTALLING AND REMOVING OUTBOARD ADAPTER BEAM.

INSTALLING

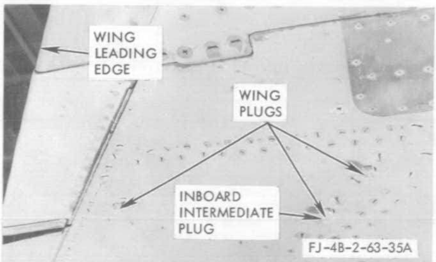
1 Remove electrical stowage fairing and fairing clip and seal from undersurface of wing.



2 Detach stowage fairing from wiring by breaking safety wires and loosening clamps holding wiring harnesses. (Any small parts to be further removed from this station can be placed in the stowage fairing for reinstallation.)

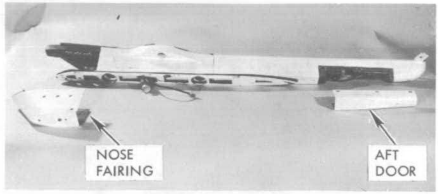


3 Remove three wing plugs and "O" rings at forward mounting points. Insert inboard forward intermediate plug and "O" ring in aft mounting point left empty by removal of stowage fairing clip.

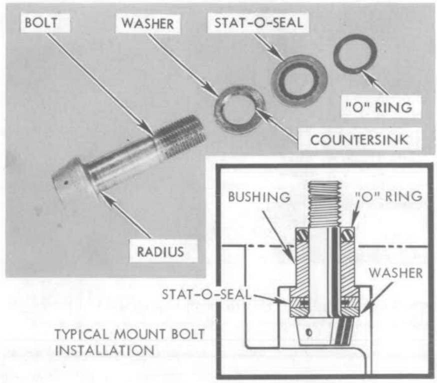


FJ-4B-2-63-35A

4 Before installation of adapter beam to the wing, remove aft door and nose fairing.

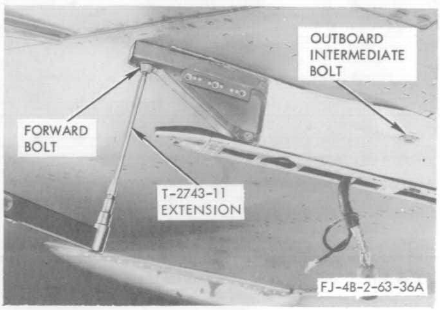


Note When installing adapter beam mounting bolts, place a fresh "O" ring in the wing bolt hole and fit countersunk washer between bolthead and Stat-O-Seal. Washer countersink must mate with radius under bolthead.



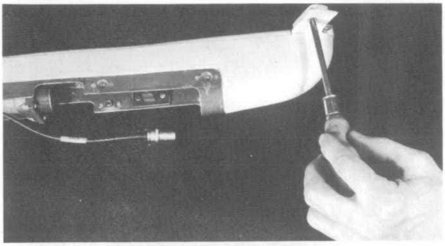
5 Position adapter beam to wing and attach with three mount bolts.

Note Do not allow weight of beam to be supported by mount bolts until all bolts are drawn up tight.

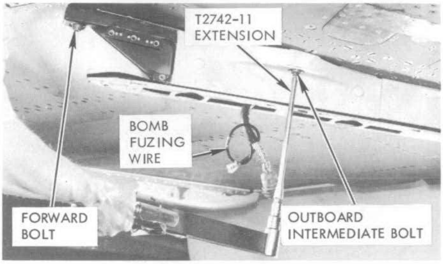


FJ-4B-2-63-36A

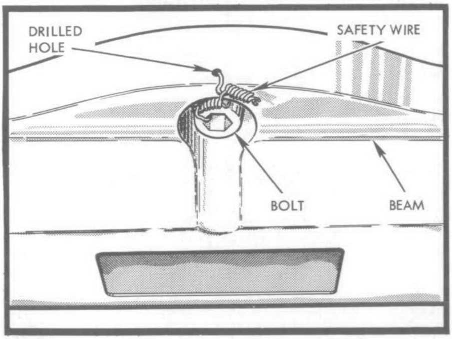
6 Install two screws at aft end of adapter beam.



7 Torque forward bolt to 60 foot-pounds and the two forward intermediate bolts to 80 foot-pounds.



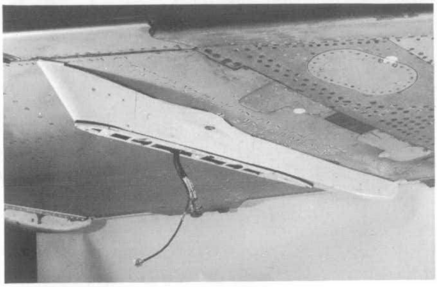
8 Safety mounting bolts through hole drilled in beam with AN995F41 wire.



9 Connect bomb-rocket harnesses and bomb fuzing wires.

10 Reinstall aft door and nose fairing.

FJ-4B-2-63-37A



REMOVING

1 Make certain electrical power has been removed from airplane.

2 Remove nose fairing and aft door.

3 Disconnect wiring harnesses.

4 Remove two screws from aft end of adapter beam.

5 Support beam and remove three mounting bolts at forward half of adapter beam.

6 Lower beam and reinstall aft door and nose fairing.

7 Remove plug from aft mounting point in wing.

8 Insert three plugs, and "o" rings in forward and intermediate mounting points in wing.

9 Clamp and safety-wire airplane's wiring harnesses into stowage fairing.

10 Install bolt, washer, fairing clip and seal at aft mounting point in wing. Torque bolt to 100 inch-pounds and safety wire.

11 Secure stowage fairing to undersurface of wing.

FJ-4B-2-63-38A

7-152. INSTALLING AND REMOVING AERO 15B OR AERO 15C BOMB RACK AND ROCKET LAUNCHER.

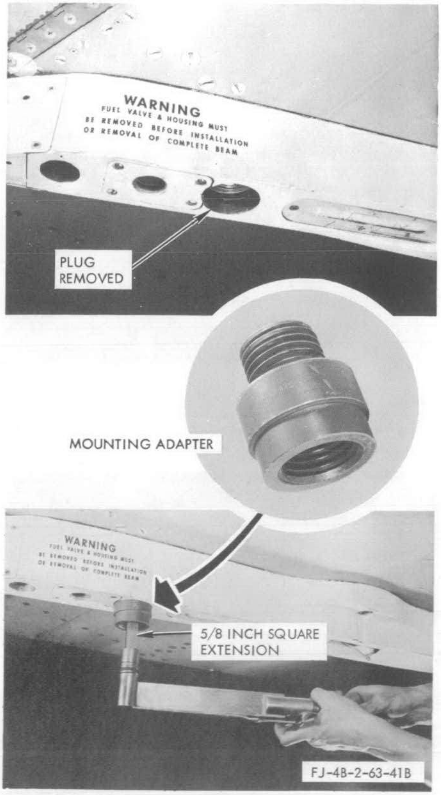
INSTALLING

Note Aero 15B or Aero 15C racks being installed for the first time must have the fairings trimmed in accordance with drawings supplied in adapter beam packages (209-63202).

Note Installing Aero 15B or Aero 15C to the adapter beam at stations 2 and 5 requires preparation not necessary for the adapter beams at other stations.

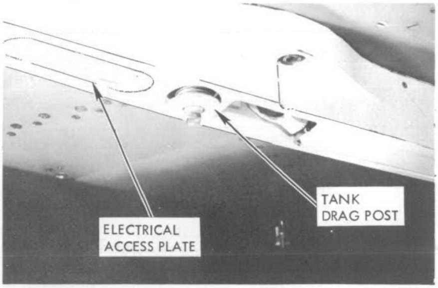
1 **To prepare adapter beam at stations 2 and 5, proceed as follows:**

A. **Remove plug from underside of beam just aft of fuel valve and housing and insert mounting adapter. Torque adapter to 90 foot-pounds.**

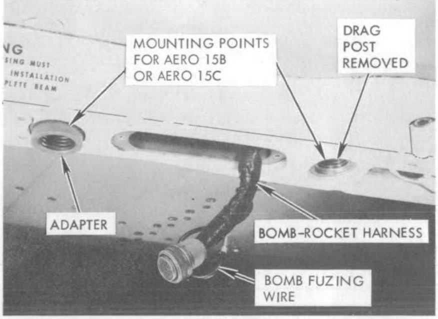


FJ-4B-2-63-41B

B. Remove tank drag post by wrenching on the flat sides.

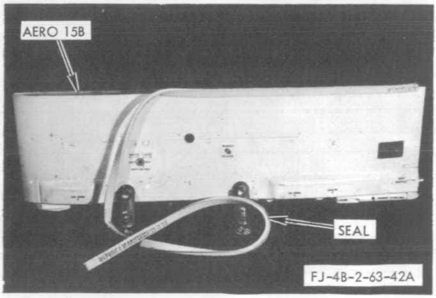


C. **Remove electrical access plate and draw out electrical wiring.**



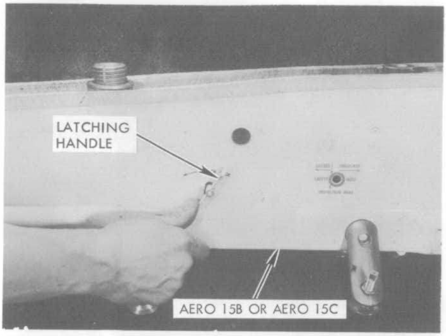
Note **The following installation procedure applies to all stations.**

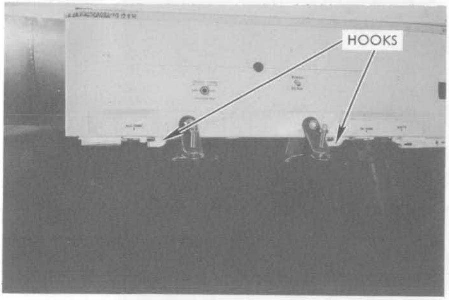
2 Fit seal around top edge of Aero 15B or Aero 15C rack.



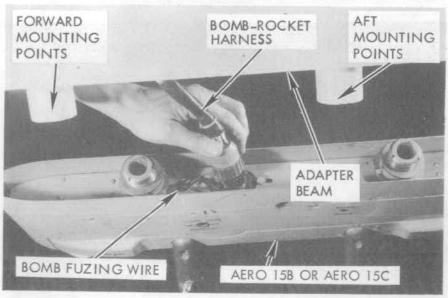
FJ-4B-2-63-42A

3 Close rack hooks by turning latching handle fully clockwise and pushing against heel of both hooks with thumbs.



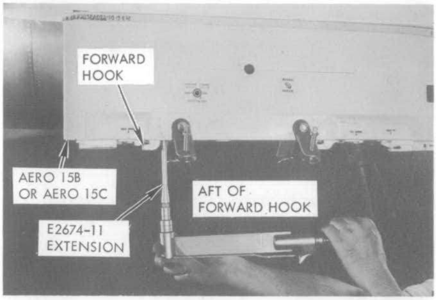


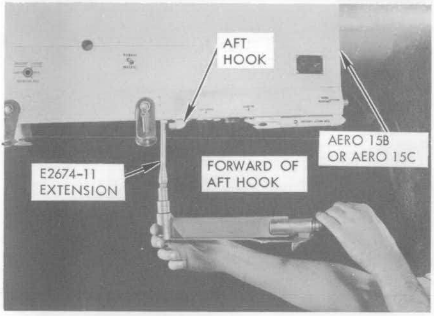
4 Raise Aero 15B or Aero 15C to adapter fuzing and connect bomb-rocket harnesses and bomb fuzing wires.



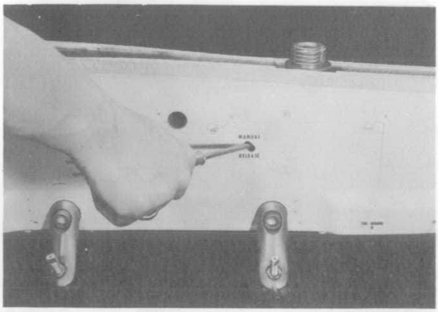
FJ-4B-2-63-43A

5 Position Aero 15B or Aero 15C to adapter beam. Insert Ruffe wrench (Part No. 14X-49) aft of forward hook and forward of aft hook and tighten from 85 to 95 foot-pounds torque.





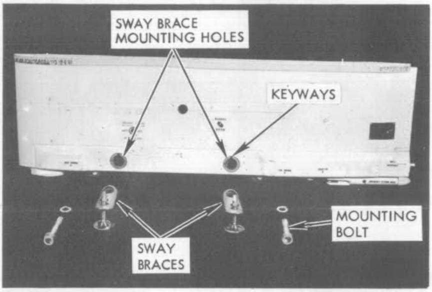
6 Insert screwdriver through manual release aperture. Pry release mechanism lever to rear and hooks will snap open.



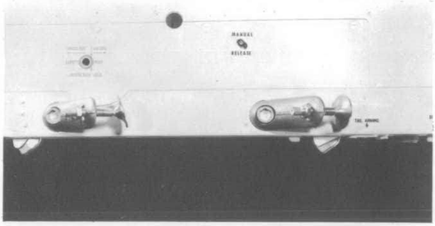
FJ-4B-2-63-44C

7-153. (Deleted.)

7 If single rockets are to be installed, loosen sway brace mounting bolts and remove sway brace from rack.



8 Rotate sway braces one-fourth turn aft. Fit sway braces into keyway in mounting hole and tighten mounting bolt.



REMOVING

1 Make certain electrical power is not applied to airplane.

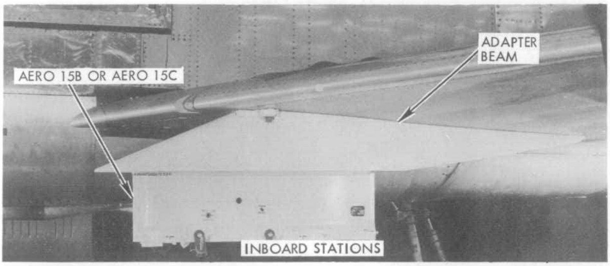
2 Turn latching handle fully counterclockwise and close hooks with thumbs.

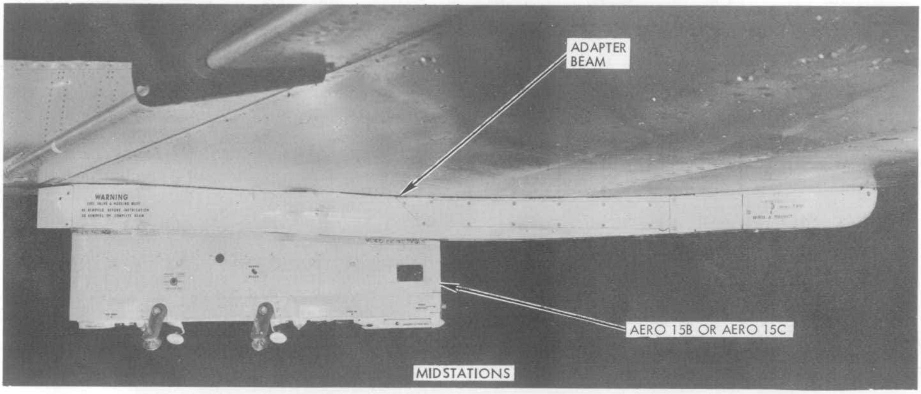
3 Support rack and loosen mounting studs aft of forward hook and forward of aft hook. Loosen mounting studs evenly to prevent binding.

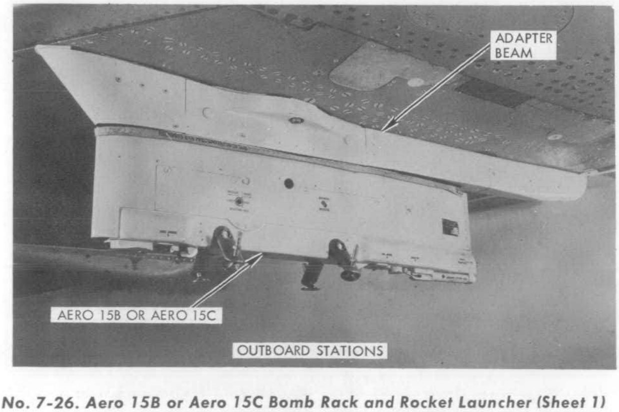
4 Disconnect electrical wiring and lower rack from adapter beam.

5 If Aero 15B or Aero 15C has been removed from stations 2 and 5, replace tank drag post, stow electrical wiring and cover with access plate. Replace mounting adapter with plug.

FJ-4B-2-63-45 A

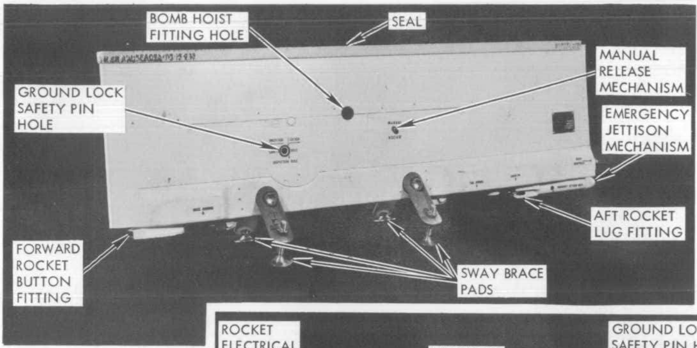


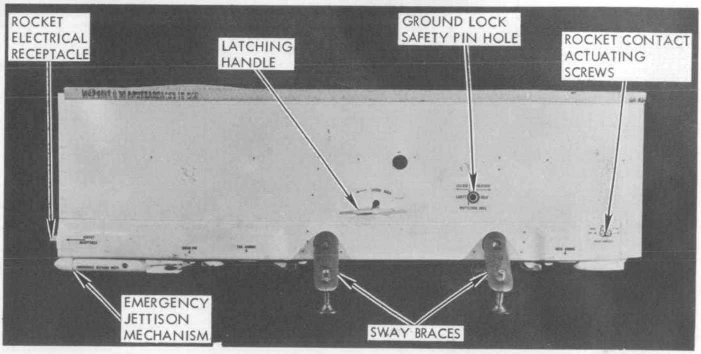


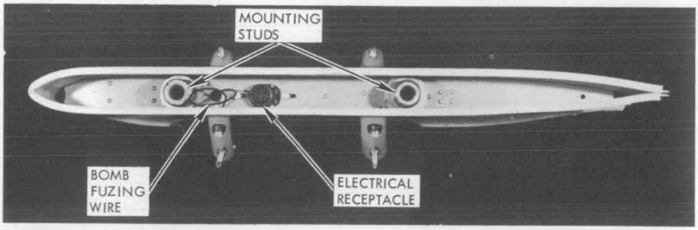


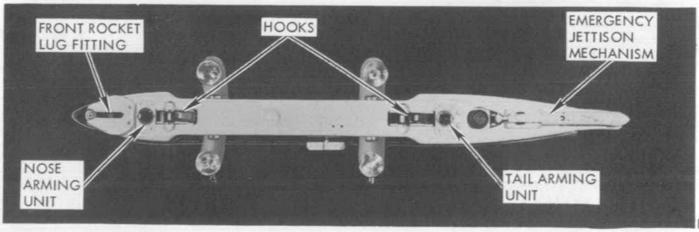
FJ-4B-2-63-39A

Figure No. 7-26. Aero 15B or Aero 15C Bomb Rack and Rocket Launcher (Sheet 1)









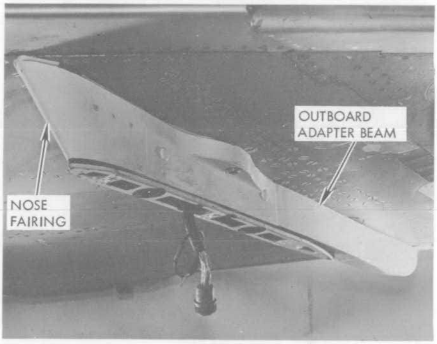
FJ-4B-2-63-46A

Figure No. 7-26. Aero 15B or Aero 15C Bomb Rack and Rocket Launcher (Sheet 2)

Pages 7-115, 7-116, 7-116A and 7-116B, paragraphs 7-153A and 7-153B, deleted.

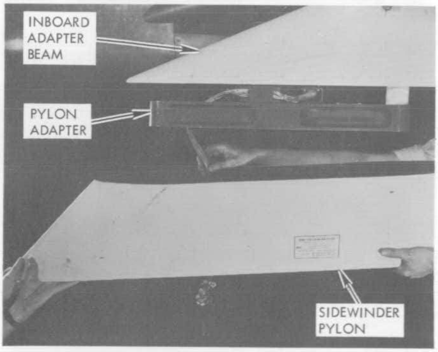
3 If installation is to be made on adapter beam at outboard stations, the following step must precede pylon installation.

A. Remove nose fairing if it is installed on the adapter beam.



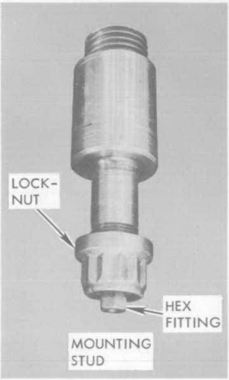
Note Further installation procedure is identical at all stations except when there is a variation peculiar to the station which will be called out.

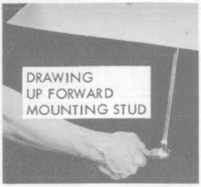
4 Raise Sidewinder pylon to adapter beam and make electrical connection. At inboard stations, Sidewinder pylon makes electrical connection with wiring harness at pylon adapter attached to adapter beam.

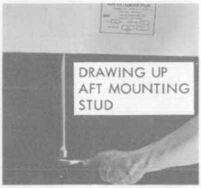


5 Attach pylon to adapter beam, drawing mounting studs part way up leaving a clearance between top of pylon and bottom of adapter beam.

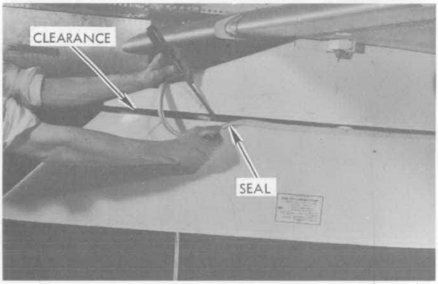
FJ-4B-2-63-77





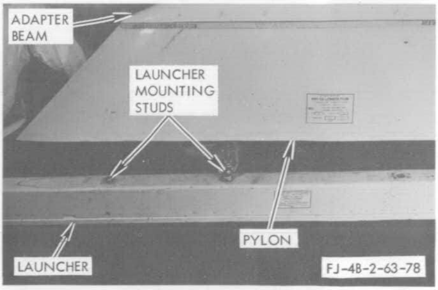


6 Fit seal around top edge of pylon with aid of screwdriver.



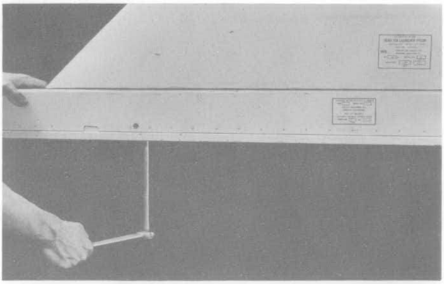
7 Torque pylon mounting studs to 40 foot-pounds. Torque mounting stud locknuts to 25 foot-pounds.

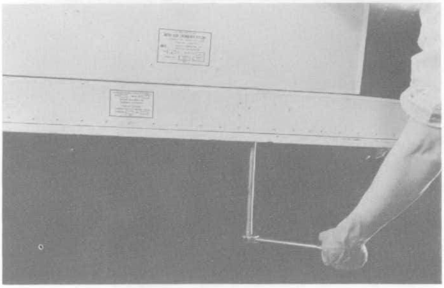
8 Raise Sidewinder launcher to pylon and make electrical connection.



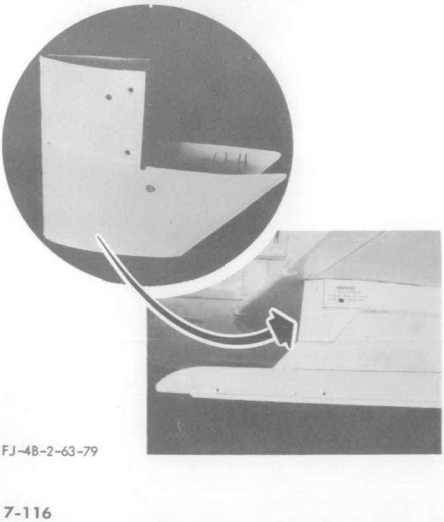
FJ-4B-2-63-78

9 Attach launcher to pylon and torque two mounting studs to 40 foot-pounds.





10 At outboard and midstations only, install special fairing to nose of adapter beam.



FJ-4B-2-63-79



REMOVING

1 Make certain electrical power has been removed from the airplane.

2 At outboard and mid stations only, remove special fairing from nose of adapter beam.

3 Loosen launcher mounting studs, disconnect electrical wiring and remove launcher from pylon.

4 Loosen pylon mounting studs, disconnect electrical wiring and remove pylon from adapter beam.

5 If removal procedure is taking place at outboard or mid stations, replace nose fairing on adapter beam.

6 If removal procedure is taking place at mid station, stow electrical harness in adapter beam and cover with electrical access plate.

A. Replace tank drag post in hole aft of electrical access plate.

B. Remove mounting adapter installed just aft of fuel valve and housing and replace with plug.

7 If removal procedure is taking place at inboard stations, loosen pylon adapter mounting bolts, disconnect electrical wiring and remove pylon adapter from adapter beam.

FJ-4B-2-63-80

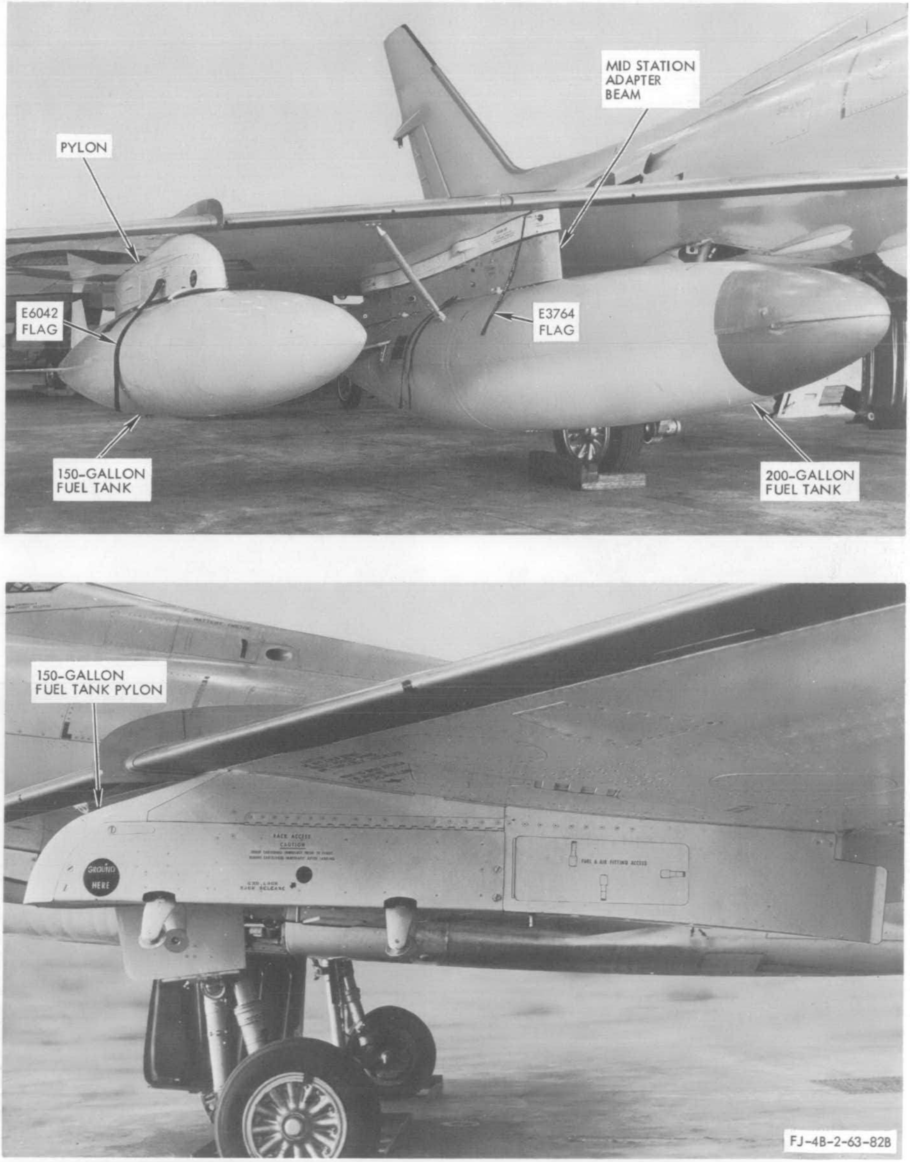
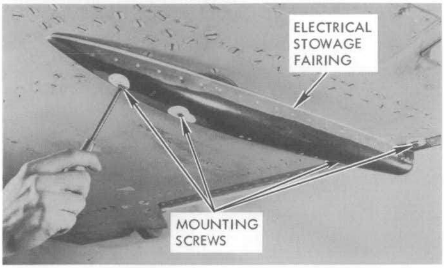


Figure No. 7-27. 150-gallon Fuel Tank Pylon—P/N 209-63212

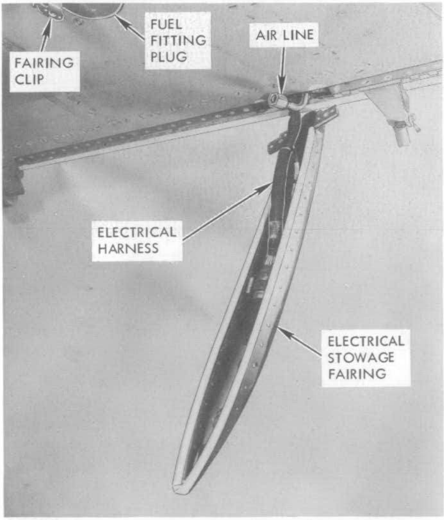
7-154. INSTALLING AND REMOVING 150-GALLON FUEL TANK PYLON.

INSTALLING

1 Remove electrical stowage fairing from undersurface of wing at outboard station.



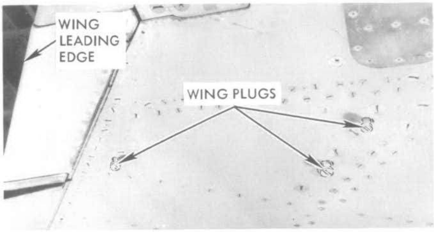
2 Remove fairing clip and fuel fitting plug from wing and stowage fairing from electrical harness.



Note The stowage fairing can be used as a container for any small parts also removed from this station.

3 Remove wing plugs and "O" rings from three forward mounting points.

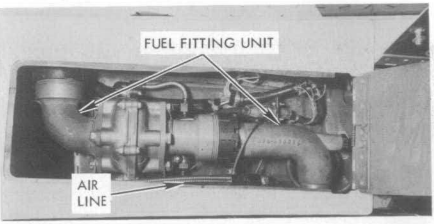
FJ-4B-2-63-84



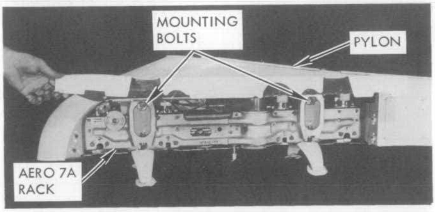
Note The pylon is completely assembled when received and must be partially disassembled before installation.

4 Remove air line, fuel fitting unit and the lower electrical plug protruding through bottom of pylon.

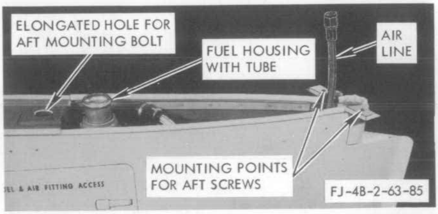
Note Entire unit accessible through fuel and air fitting access door. Access door must be removed to allow for installation of pylon aft mounting bolt.



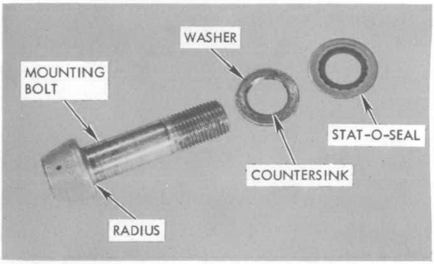
5 Remove Aero 7A rack from pylon.



6 Attach air line and fuel housing with tube removed from pylon to appropriate fittings in wing.



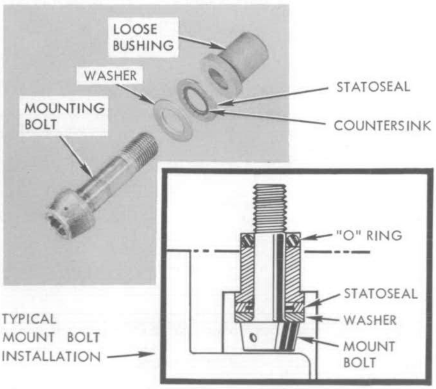
Note When installing pylon, install new "O" rings in wing mounting bolt holes, place mounting bolt washer between bolthead and Stat-O-Seal. Make certain washer countersink mates with radius under bolthead.



7 Raise pylon to wing and attach with three forward mounting bolts.

Note Do not allow weight of pylon to be supported by mounting bolts until bolts are snugged down.

8 Slip loose bushing over aft mounting bolt and insert bolt through elongated hole.

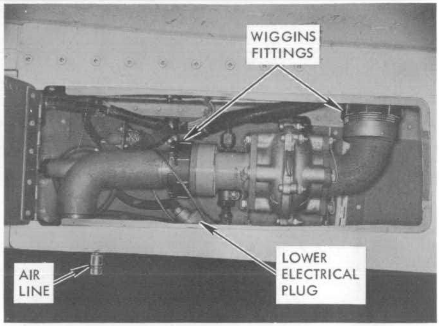


9 Install two screws through ears at aft end of pylon.

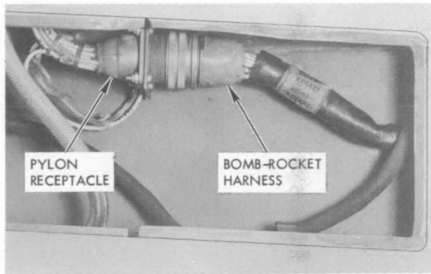
10 Torque front mounting bolt to 60 foot-pounds and remaining bolts to 80 foot-pounds. Safety mounting bolts with AN995B40 wire.

11 Replace and connect fuel fitting unit; lower electrical plug and locate air line and arming cable in proper positions. Apply 30 foot-pound torque to Wiggins fuel fittings.

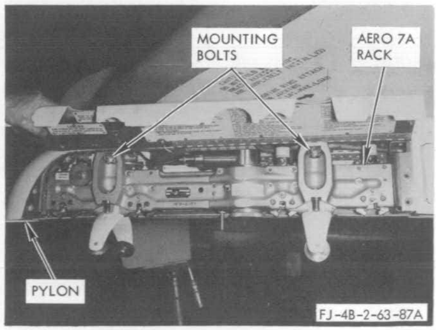
FJ-4B-2-63-86A



12 Connect bomb-rocket harness to electrical receptacle in pylon.



13 Reinstall Aero 7A rack in pylon. Torque mounting bolts to 250 foot-pounds. Safety mounting bolts with AN995B40 wire.



14 Make Aero 7A rack electrical connections.

Note For further information regarding fuel tank installation, refer to paragraph 4-278

REMOVING

1 Make certain electrical power has been disconnected from airplane.

2 Disconnect electrical wiring and remove Aero 7A rack from pylon.

3 Disconnect bomb-rocket harness from pylon electrical receptacle.

4 Loosen arming cable and lower end of air line.

5 Remove fuel fitting unit and lower electrical plug.

6 Remove two screws from ears at aft end of pylon.

7 Remove four mounting bolts and lower pylon from wing.

8 Detach fuel housing with tube and air line from wing.

9 Replace wing plugs in three forward mounting points.

10 Reinstall bolt, washer, fairing clip, seal and torque bolt to 100 inch pounds and safety wire.

10A Reinstall fuel fitting plug in wing.

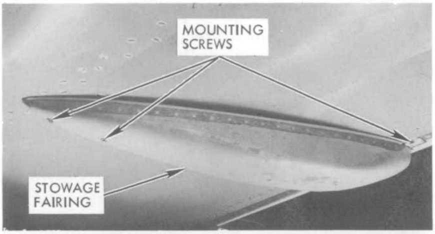
11 Secure electrical wiring from wing in stowage fairing.

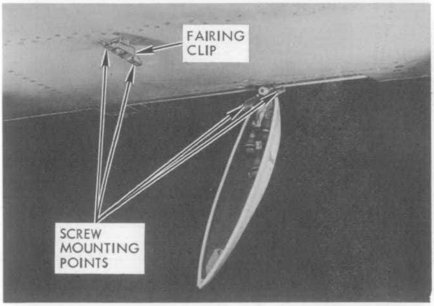
12 Swing stowage fairing up to undersurface of wing and attach with four screws.

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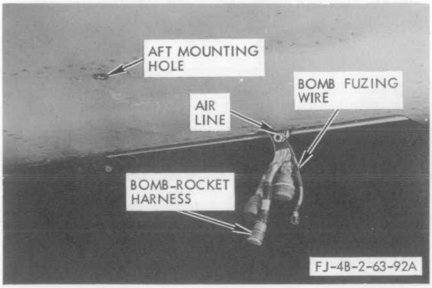
INSTALLING

1 Remove four screws from electrical stowage fairing. Fairing will swing down from undersurface of wing.



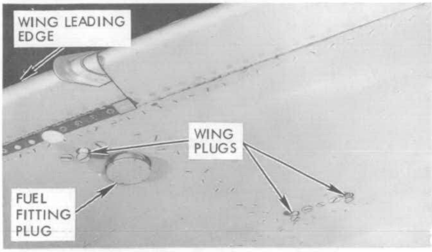


2 Remove bolt, washer, fairing clip and seal from wing and detach stowage fairing from wiring by breaking safety wires and loosening clamps holding wiring harness. (Any small parts to be further removed from this station can be placed in the stowage fairing for reinstallation.)

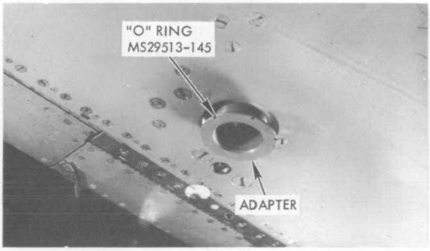


FJ-4B-2-63-92A

3 Remove wing plugs and "O" rings from undersurface of wing at forward mounting points. Use special tool, T2707 (figure 7-30), to remove the fuel fitting plug.



4 Install adapter and "O" ring into wing fuel fitting.



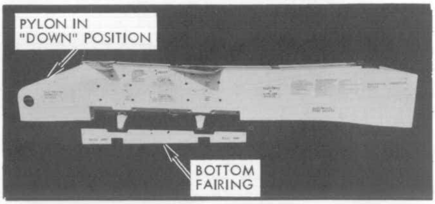
5 Remove wing plug from aft point and plug from air line. Place a fresh "O" ring in each wing bolt hole.

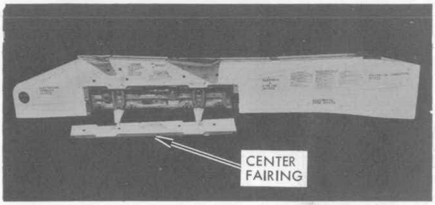
Note The universal pylon is used in the "down" position at the left-hand wing mid station only. (See figure 7-28.) It is used in this position when the Mark 12 store is to be installed.

Note The universal pylon is completely assembled when received and must be partially disassembled before installation.

FJ-4B-2-63-93B

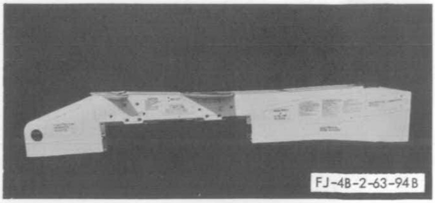
6 Remove bottom and center fairings.



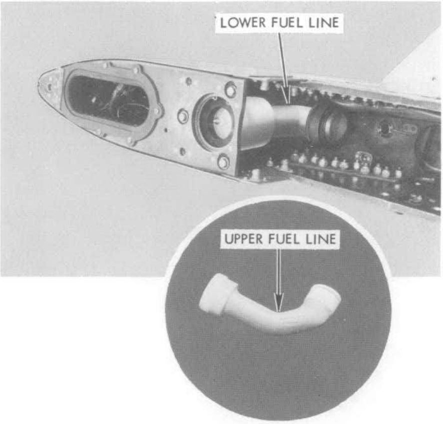


7 Remove Aero 7A rack and upper fuel line fitting.





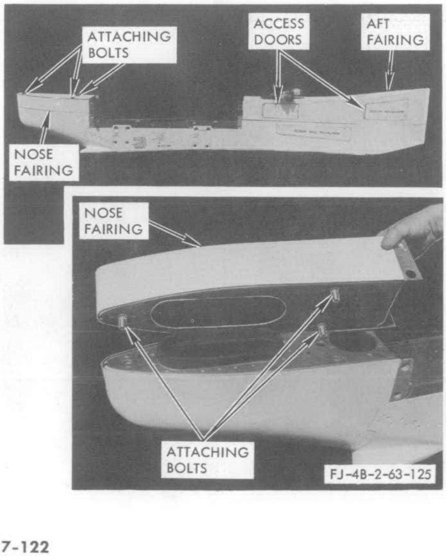
FJ-4B-2-63-94B



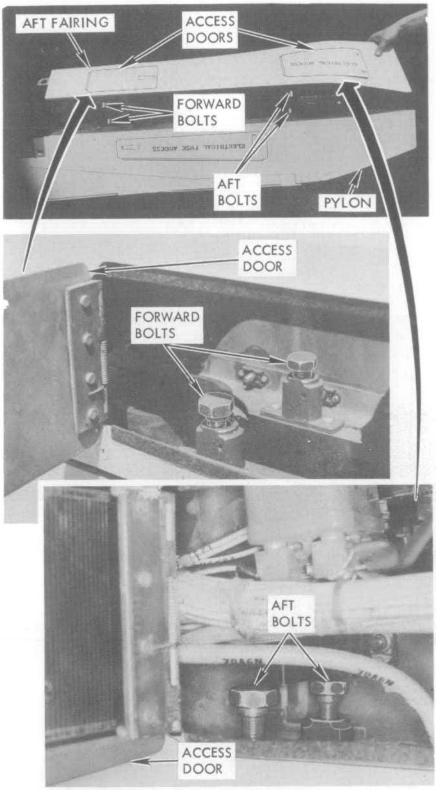
Note At this point the universal pylon is ready to mount in the wing. However, if stores other than the Mark 12 are to be installed, further disassembly is necessary.

8 For stores other than Mark 12, prepare pylon as follows:

A. Place pylon upside down and remove nose fairing.

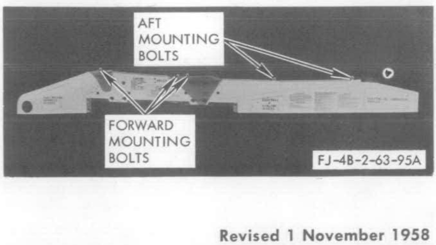


B. Unscrew four attaching bolts (reached through access doors) and remove aft fairing from pylon.

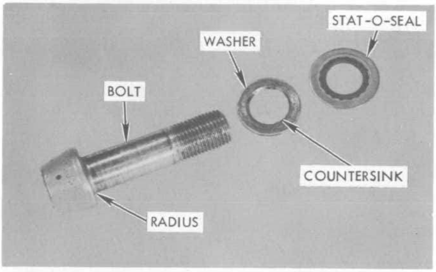


Note At this point, the universal pylon is in the "UP" position. The following installation procedure applies to the universal pylon in either the "UP" or "DOWN" position. Any differences will be pointed out.

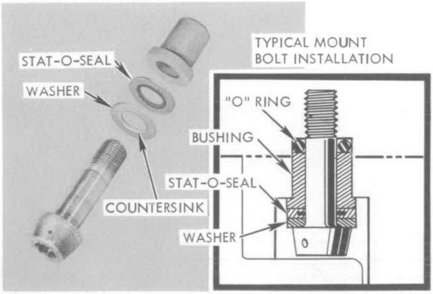
9 Raise pylon to wing and attach with five mounting bolts.



Note When installing mounting bolts, fit countersunk washer between bolthead and Stat-O-Seal. Washer countersink must mate with radius under head of bolt.



10 In addition to countersunk washer and Stat-O-Seal, slip loose bushing over aft mounting bolts before installing in pylon.



Note Do not allow weight of pylon to be supported by mount bolts until all bolts are drawn up snug.

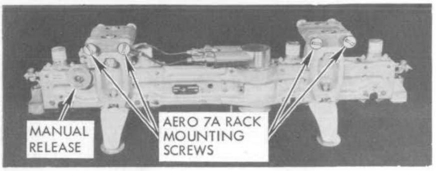
11 Apply 180 foot-pounds torque to front mount bolt and 120 foot-pounds torque to remaining four bolts.

Note Torquing sequence for bolts is: front, inboard front, outboard front, aft intermediate and aft. The sequence must be in that order.

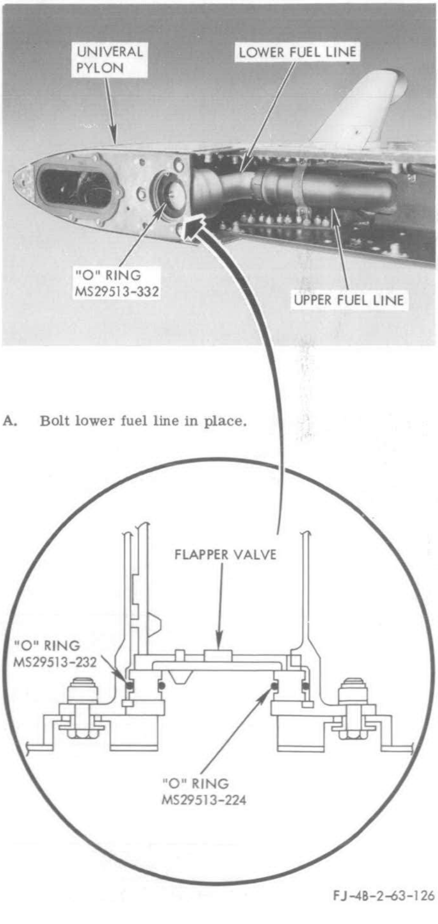
12 Reinstall Aero 7A rack in pylon and apply from 50 to 60 foot-pounds torque to mounting screws.

Note Make certain rack hooks are open before installing rack in pylon. Turning manual release counterclockwise will open hooks.

FJ-4B-2-63-96B



13 Install pylon fuel line to wing.

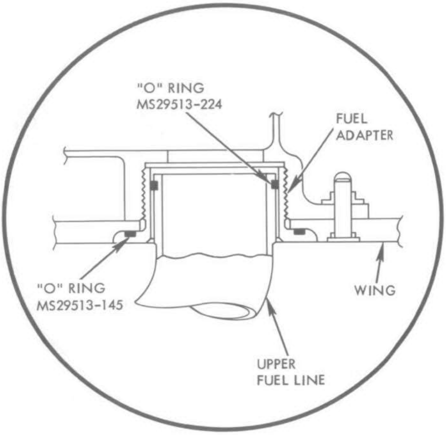


A. Bolt lower fuel line in place.

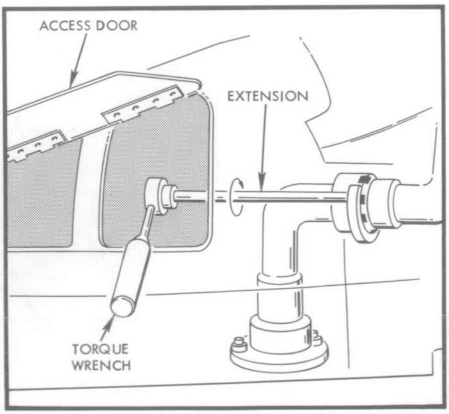
FJ-4B-2-63-126

B. Check "O" ring condition and replace if necessary.

C. Position "O" ring end of fuel line into wing fitting. (Be sure "O" ring seats properly.)

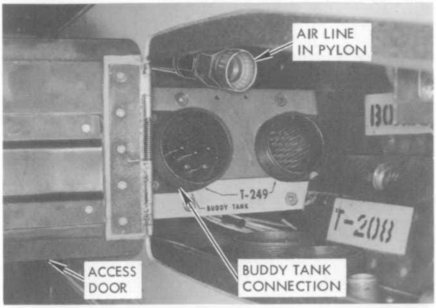


D. Connect fuel coupling nut and torque to correct value. (See figure 4-8.)

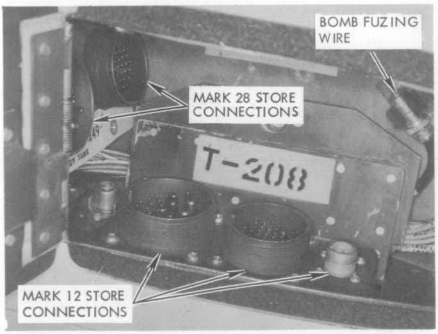


FJ-4B-2-63-127

14 Connect air line in aft end of pylon to air line in wing.

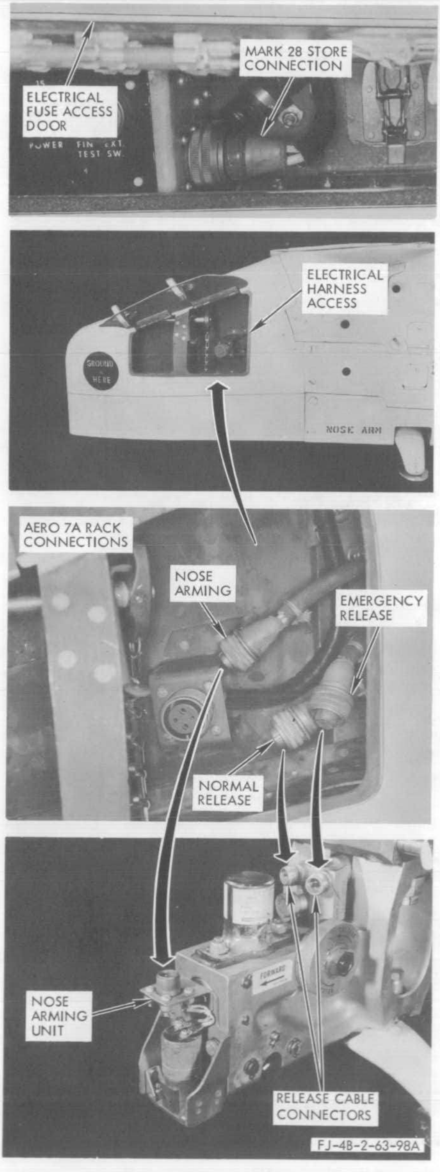


15 Make necessary electrical connections according to type of store to be carried.





FJ-4B-2-63-97B



FJ-4B-2-63-98A

16 Connect pylon arming nose and tail cable to arming units at each end of Aero 7A rack. Connect normal and emergency release electrical harness to rack.

17 Safety-wire applicable mounting bolts and electrical connection with AN995F41 wire.

18 Replace and secure all applicable fairings.

REMOVING

1 Make certain electrical power is removed from airplane.

2 Remove fairings and disconnect all electrical wiring.

3 Remove fuel fittings and disconnect air lines.

4 Remove Aero 7A rack from pylon.

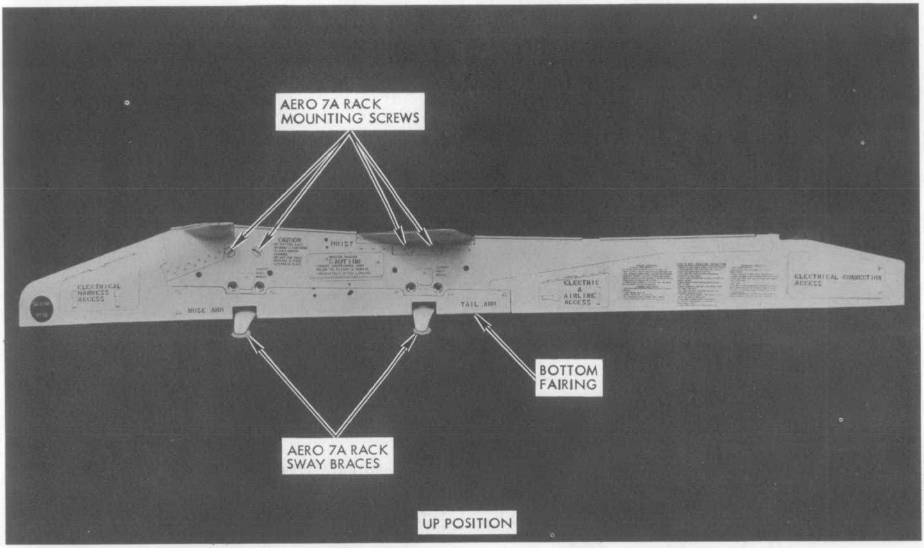
5 Remove five mounting bolts and lower pylon from wing.

6 Replace fuel fitting plug, four plugs and "O" rings at wing mounting holes.

7 Reinstall fairing clip and seal to wing, torque bolt to 100 inch-pounds and safety-wire.

8 Stow wiring harnesses from wing in clamps in stowage fairing and attach stowage fairing to undersurface of wing.

FJ-4B-2-63-99B



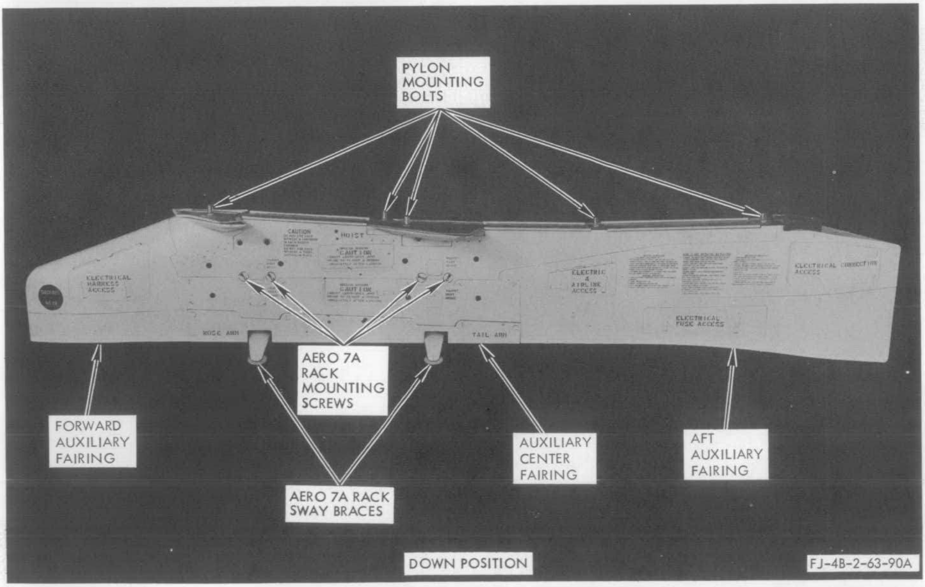


Figure No. 7-28. Universal Pylon—P/N 209—63413

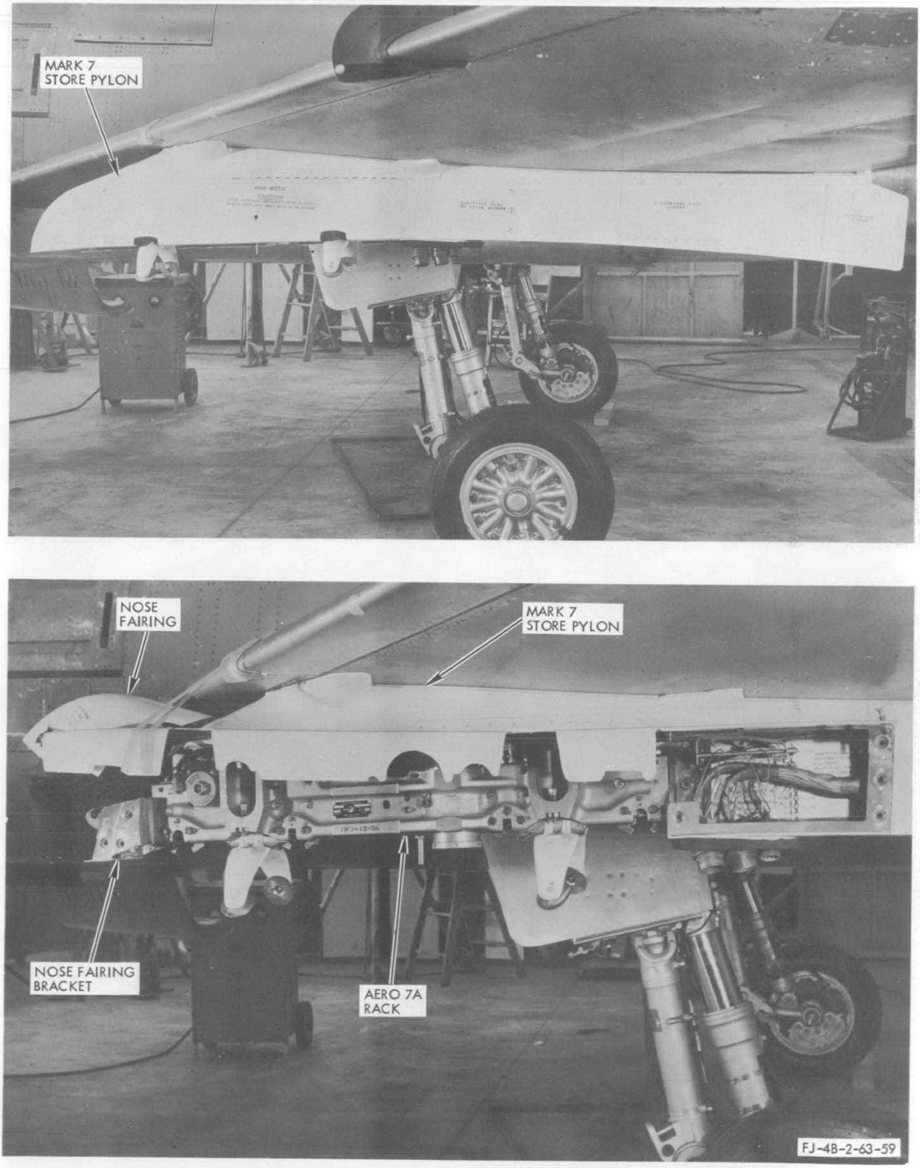
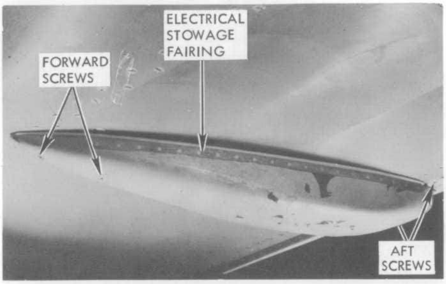


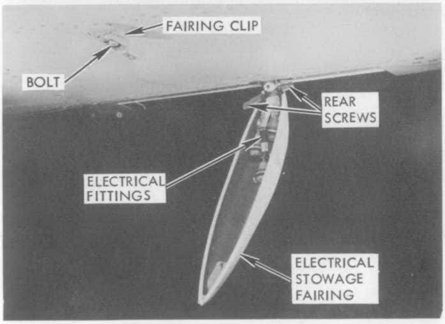
Figure No. 7-29. Mark 7 Store Pylon—P/N 209—63313

7-156. INSTALLING AND REMOVING MARK 7 STORE PYLON.

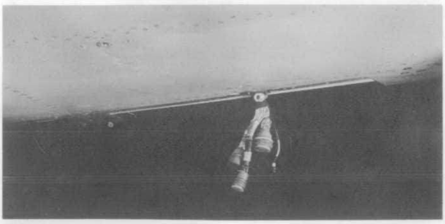
INSTALLING

1 Remove electrical stowage fairing from under surface of wing by removing the two forward and two rear screws from fairing.



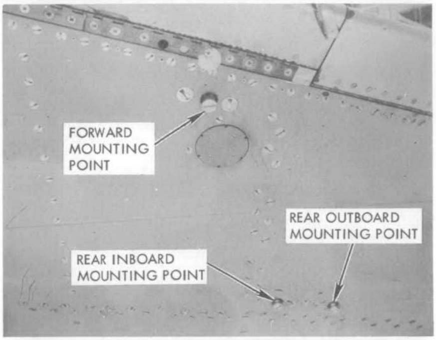


2 Remove fairing clip, seal and bolt from undersurface of wing and electrical fittings from inside fairing. Any small parts to be further removed from this station can be placed in fairing.

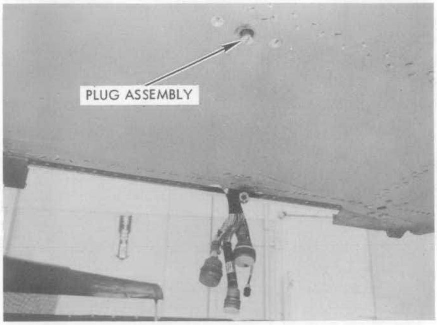


3 Remove the plug assemblies and "O" rings from the forward mounting points.

FJ-4B-2-63-61A



4 Insert plug assembly (209-63063-51) and "O" ring, from one of the forward mounting points, into wing in place of removed fairing clip.



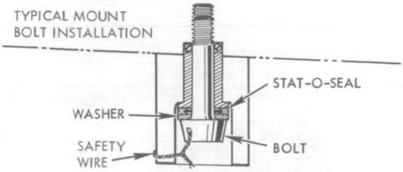
Note The following sequence must be followed to avoid installing a twist in pylon.

5 With all Mark 7 stores pylon doors closed and secured, raise pylon and install front mount bolt (MS20010H20) with Stat-O-Seal between washer and adapter beam. Install aft inboard mount bolt (MS20009H20) with Stat-O-Seal between washer and adapter beam. Tighten bolts through cutouts in bottom of doors. (Use special tools; E2746, T2709-11 and E2675, see figure 7-30.)

Note Do not allow weight of pylon to be supported by mount bolts until mount bolts have been snugged down.

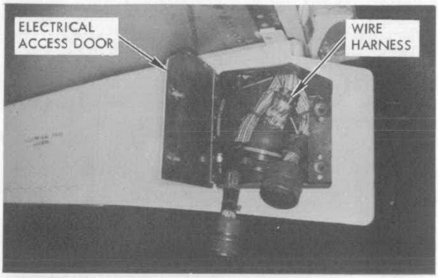
Note When installing adapter beam mounting bolts, place a fresh "O" ring in wing bolt hole and fit countersunk washer between bolthead and Stat-O-Seal. Washer countersink must mate with radius under bolthead.

FJ-4B-2-63-62A



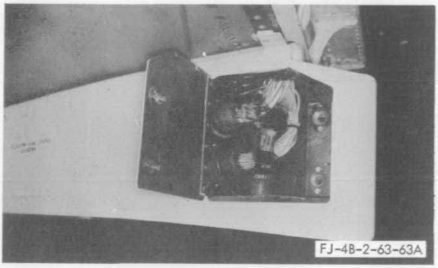
6 Install rear fairing screws (AN509-10R14); then open doors and install rear outboard bolt (MS20009H20) with Stat-O-Seal between washer and adapter beam. Tighten bolt.

Note For greater ease in installing rear fairing screws, open the electrical access door at rear of pylon and feed wiring from wing through door.



7 Apply 180 foot-pounds to front mount bolt and 120 foot-pounds to aft inboard bolt and then to aft outboard bolt. Torquing sequence must be followed. Safety bolts with AN995F41 safety wire.

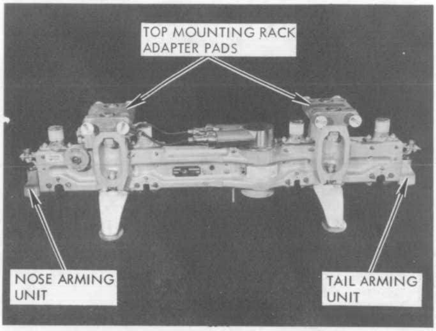
8 Connect electrical plugs from wing to pylon through access doors in rear fairing.



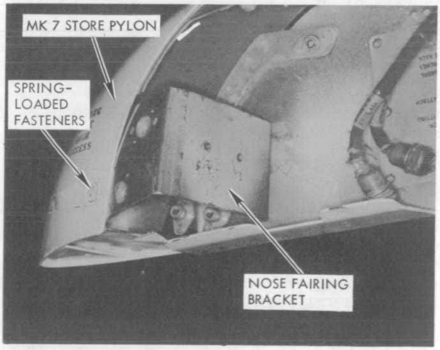
FJ-4B-2-63-63A

9 Remove Aero 7A bomb rack from universal pylon. (Refer to paragraph 7-155.)

10 Remove both nose and tail arming units from Aero 7A bomb rack by removing the two bolts in each unit. Insert two AN24-8 bolts in open bolt holes at rear of rack. Remove two mounting pads from rack.

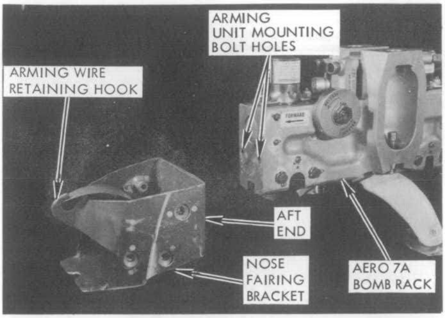


11 Remove nose fairing bracket from Mark 7 store pylon by opening rack access doors and, then, releasing the spring-loaded fasteners on each side of the nose fairing.

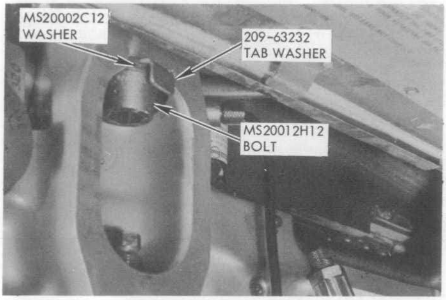


12 Mount nose fairing bracket on Aero 7A bomb rack, forward end, by installing two AN24-8 bolts through the two holes provided in the aft end of the bracket and into the same two holes on the Aero 7A bomb rack that held the bolts for the nose arming unit. Install with arming hook pointed up.

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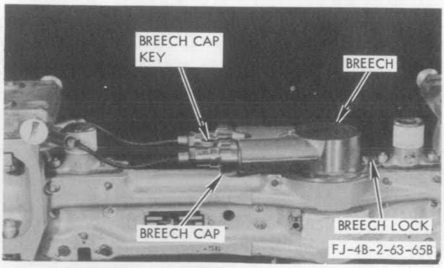


13 Raise and install Aero 7A bomb rack into Mark 7 stores pylon, using four MS20012H12 bolts, MS20002C12 washers and 209-63232 tab washers. Use special tool T2832. If IFR probe is installed, use standard extension (Snap On L-62) 3/4-in. extension 8-in. long, or equivalent, in conjunction with T2832. (See figure 7-30.)



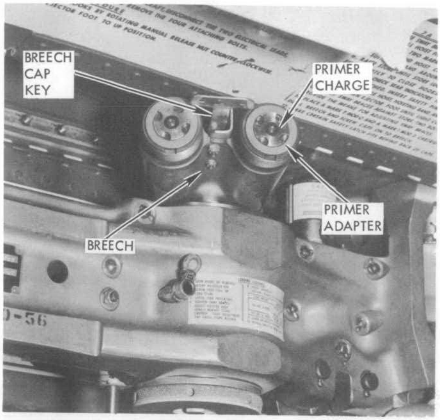
14 Apply 250 foot-pounds torque to bolts and safety bolts to tab washers with AN995F41 safety wire.

15 Raise breech cap retainer in center of breech and unscrew breech caps. Turn breech lock and rotate breech toward outboard position.



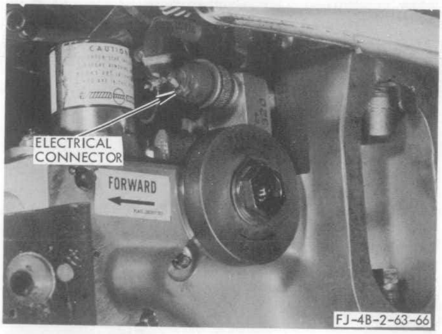
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16 Inspect breech for primer charges and remove if any are present. Do not remove primer adapters at this time.



17 After removing primer charges, return breech to original position and replace breech caps.

18 Make electrical connections between Aero 7A bomb rack and MK 7 stores pylon.



FJ-4B-2-63-66

REMOVING

1 Remove electrical power to external stores.

2 Remove electrical connections between Aero 7A bomb rack and Mark 7 stores pylon.

3 Remove bolts holding Aero 7A bomb rack to Mark 7 stores pylon and lower rack from pylon.

4 Open electrical access door at rear of Mark 7 stores pylon and remove electrical connections.

5 Open doors of Mark 7 stores pylon and remove rear outboard mount bolt; then, remove rear fairing screws.

6 Close pylon doors. Remove rear inboard mount bolt and forward mount bolt. Lower pylon from wing.

7 Insert plug assembly (209-63063-61) and "O" ring into wing at forward mount point. Insert plug assembly (209-63063-51) and "O" ring into wing at both rear mount points.

Note One plug assembly (209-63063-51) is obtained by removing from hole in wing provided for fairing clip and bolt seal.

8 Install fairing clip and bolt seal into wing and torque bolt to 100 inch-pounds.

9 Clamp electrical plugs to inside of fairing.

10 Install fairing to wing, using two AN509-10R14 screws at rear and two AN509-10R8 screws at forward positions.

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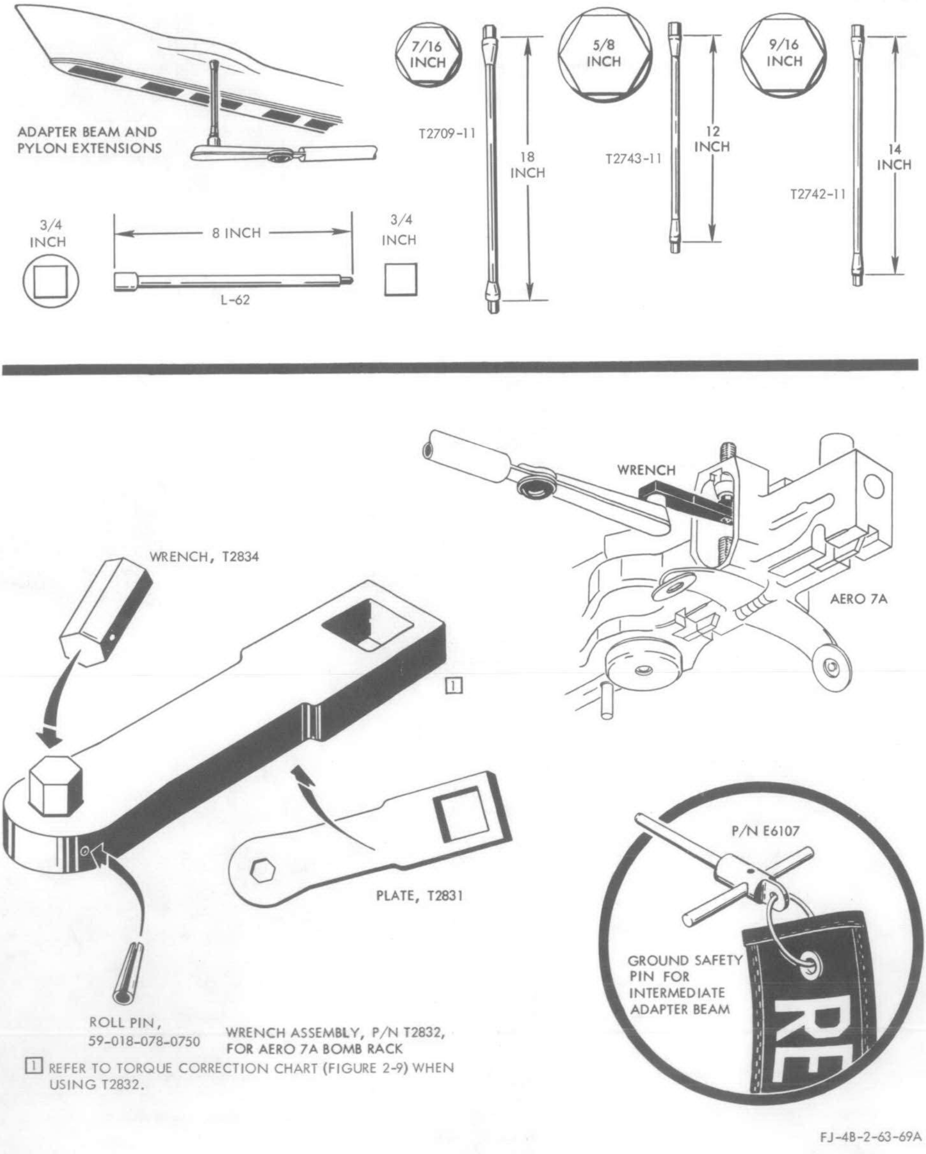
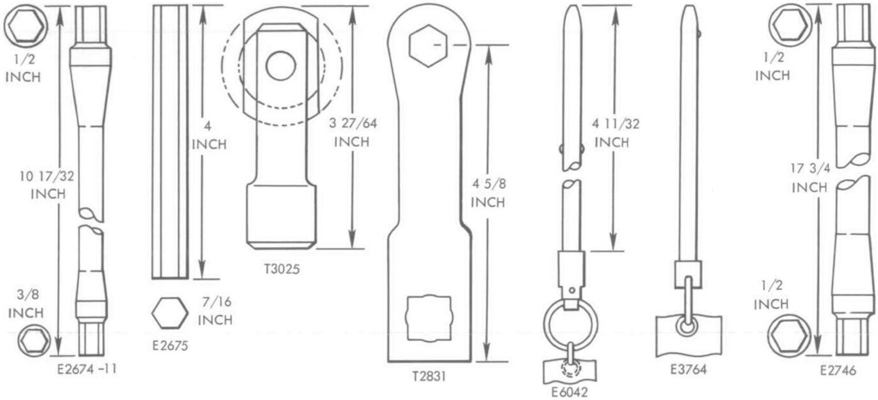


Figure No. 7-30. External Stores Special Tools (Sheet 1)



NOTE: SPECIAL TOOL APPLICATION CAN BE DETERMINED BY CHECKING TOOL NUMBER IN LEFT COLUMN AGAINST CORRESPONDING SQUARE IN APPLICATION COLUMN.

TOOL NUMBER	TOOL NOMENCLATURE	APPLICATION	WING STATIONS
T-2709-11	WRENCH - PYLON BEAM 18" EXTENSION	209-63210 209-63313 209-63413 209-63513	3,4 INBOARD 2,5 MID STATION 2,5 MID STATION 2,5 MID STATION
E-2746-11	WRENCH - 1200 LB. BOMB PYLON	209-63313 209-63413 209-63513	2 MID STATION 2,5 MID STATION 2,5 MID STATION
E-2675	WRENCH 1200 LB. BOMB PYLON REAR MOUNT BOLT	209-63313	2 MID STATION
T-2743-11	WRENCH - PYLON BEAM 12" EXTENSION	209-63212 209-63312	1,6 OUTBOARD 1,6 OUTBOARD
T-2742-11	WRENCH - PYLON BEAM 14" EXTENSION	209-63212 209-63312	1,6 OUTBOARD 1,6 OUTBOARD
E-2674-11	WRENCH - AERO 15B OR AERO 15C BOMB RACK	AERO 15B OR AERO 15C BOMB RACK	ALL STATIONS
T-2832	WRENCH ASSY - AERO 7A	AERO 7A RACK	1,6 OUTBOARD 2,5 MID STATION
T-3025	ADAPTOR ASSEMBLY - HI TORQUE SOCKET	209-63413	2,5 MID STATION
T-2831	PLATE - AERO 7A PYLON WRENCH	BULLPUP PYLONS AERO 3A PYLONS AND LAUNCHERS	ALL STATIONS ALL STATIONS
E-3764	GROUND SAFETY PIN ASSEMBLY-1200# BOMB PYLON AND DROP TANK BEAM ADAPTOR	209-63513	2,5 MID STATION
E-6042	GROUND SAFETY PIN ASSEMBLY - UNIVERSAL PYLON	209-63413 209-63212	2,5 MID STATION 1,6 OUTBOARD
L-62	3/4 INCH EXTENSION 8 INCHES LONG, (SNAP-ON OR EQUIVALENT)	USED IN CONJUNCTION WITH T2832 IF INFLIGHT REFUELING PROBE HAS BEEN INSTALLED.	
E-6107	SUPERSEDED BY E-3764		

FJ-4B-2-63-128A

Figure No. 7-30. External Stores Special Tools (Sheet 2)

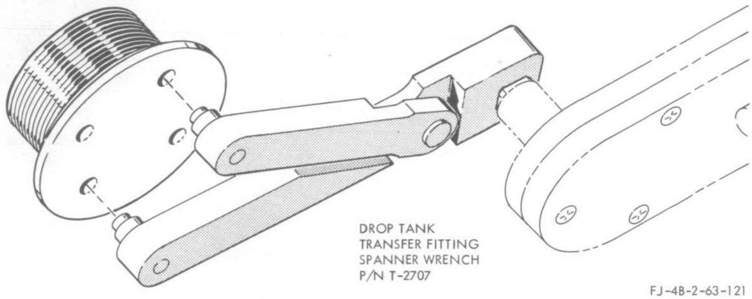


Figure No. 7-30. External Stores Special Tools (Sheet 2)

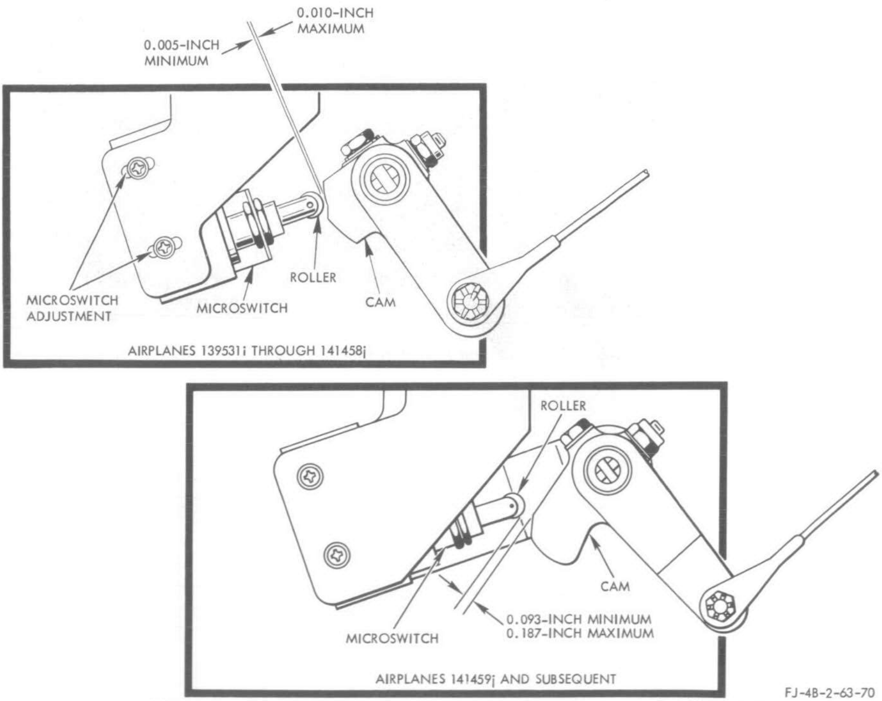


Figure No. 7-31. External Stores Emergency Release Microswitch Adjustment

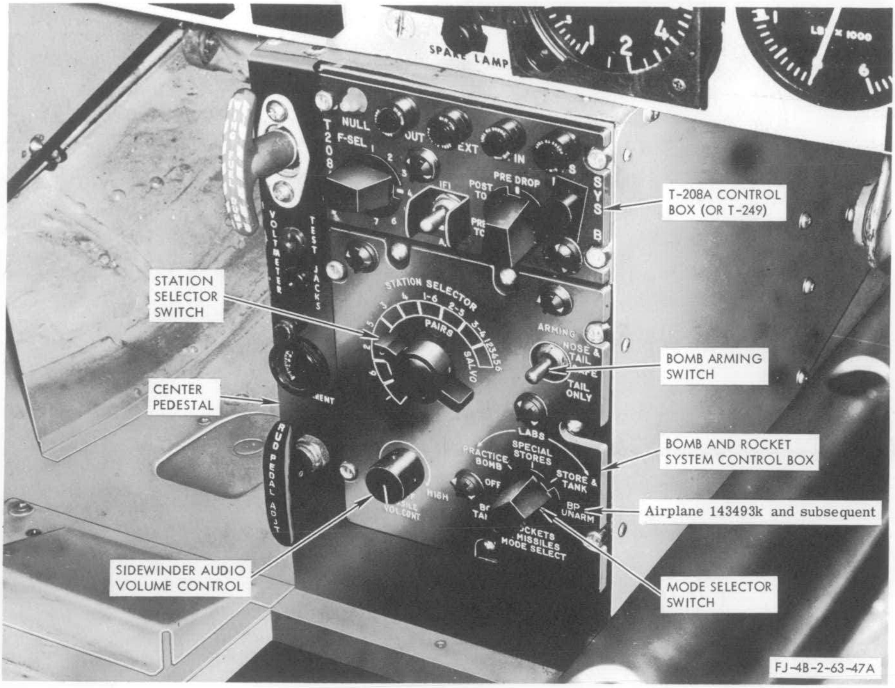


Figure No. 7-32. Bomb and Rocket System Control Box

BOMBING SYSTEM

7-157. BOMBING SYSTEM.

7-158. The installation of equipment contained in the various 209-63202 packages prepares the airplane's six wing stations for receiving a variety of external stores. With the appropriate equipment installed, the capabilities for bombs are as follows: bombs up to 500 pounds at all stations or bombs over 500 pounds at mid stations only. (See figure 7-21.) The installation of adapter beams and Aero 15B or Aero 15C bomb-rocket racks equips the six stations to carry bombs up to 500 pounds in size. Universal pylons can be installed at stations 2 and 5, equipping both stations to carry 1000- or 2000-pound bombs or the in-flight refueling tanker package. The installation of the universal pylon at station 2 further equips that station to carry a Mark 12 or a Mark 28 store. A special pylon is provided and can be installed at station 2 to equip that station to carry a Mark 7 store. [Refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).] Both the universal pylons and the special pylon incorporate an Aero 7A ejector bomb rack. Bombs can be carried in conjunction with auxiliary fuel tanks and/or rockets as long as the combination is symmetrical. In addition, the TANK—BOMB & ROCKET microswitch on the mid station adapter beam rear fairing must be previously positioned in accordance with the type of store to be carried. (Refer to paragraph 7-150.) The bomb complement can be released by single stations, by paired stations, or all bombs can be salvoed simultaneously. In addition, bombs carried at any of the external stores stations can be released through the low altitude bombing system (LABS). (See figure 7-22.) The bombs can be jettisoned by either of two emergency jettison systems.

CAUTION

The external stores emergency release circuit breaker should be disengaged when the airplane is on the ground, to prevent unintentional jettisoning of external stores.

7-159. FUNCTION OF BOMBING SYSTEM.

7-160. Bombing control is accomplished through the bomb and rocket system control box installed in the center pedestal. (See figure 7-32.) Included on the control box is a station selector switch (STATION SELECTOR), a mode selector switch (MODE SELECT) and a bomb arming switch (ARMING). To release the bombs, the circuit breakers (ARMAMENT BUS, BOMB & GUN TRIGGER, MODE SELECT & BOMB ARM, BOMB & ROCKET FIRE STA 3 & 4, BOMB & ROCKET FIRE STA 2 & 5, BOMB & ROCKET FIRE STA 1 & 6, STORES & TANK JETTISON, STORES JETTISON & DROP TANK TRANSFER and EXTERNAL STORES & EMERGENCY RELEASE) must be engaged. To release the bombs normally, position the ARM MASTER switch to "ON" and the MODE SELECT switch to "BOMBS & TANKS." Bomb arming can be selected through the arming switch. Positioning the ARMING switch to "NOSE & TAIL" energizes the respective arming solenoids in the bomb racks, securing both the nose and tail arming wires so that both arming pins are pulled at bomb departure. With "TAIL ONLY" selected, the nose arming solenoids in the bomb racks are not energized. This allows the nose arming wires to be retained by the bomb at bomb departure. Positioning the ARMING switch to "SAFE" will allow the bombs to be dropped unarmed. To release the bombs singly, position the STATION SELECTOR switch to "1" and depress the bomb-rocket release button. Electrical power is routed through the release button switch, the mode selector switch, the selected contact of the station selector switch and through the firing and armament selector relays to station No. 1 bomb rack. When the bomb-rocket release button is released, the station selector advance solenoid is de-energized, automatically advancing the station selector switch to the next station in sequence. The automatic station advance will advance the station selector switch each time the release button is depressed and released until the bombs have been released from all stations. To release the bombs in paired stations, the STATION SELECTOR switch is initially positioned to "1-6." The bombs at stations 1 and 6 will then be released when the bomb-rocket release button is depressed. When the release button is released, the STATION SELECTOR switch will automatically advance to "2-5," the next station in sequence. The station selector switch will continue to advance automatically until all bombs have been released. To release the bombs through the low altitude bombing system (LABS), position the MODE SELECT switch to "PRACTICE BOMBS," energizing the practice bomb relay. Energizing the practice bomb relay removes power from the station selector automatic advance solenoid and connects the release circuit from the LABS system to the center contact of the station selector switch. (See figure 7-22.) Position the station selector switch to the desired station from which the bomb is to be dropped. The bomb at the selected station can then be released through the LABS system. [For function of the LABS system, refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).] The automatic station advance feature of the station selector switch does not operate when releasing bombs through the LABS system. Each station from which it is desired to release bombs must be selected manually. To salvo the bombs from all stations, manually position the STATION SELECTOR switch to "SALVO." Depressing the bomb-rocket release button then routes electrical power through the salvo relay to each of the bomb rack release circuits. All bombs will be released simultaneously. The bombs can be jettisoned from all stations by pressing the STORE & TANK JETTISON button

or by pulling the JET EXTL STORES handle. Power is available to the external stores emergency release switch (actuated by the JET EXTL STORES handle) any time the battery is installed. The airplane generator can also supply power to the switch through the primary bus when the D.C. POWER switch is in the "BAT. & GEN" position. The STORE & TANK JETTISON button operates only when the weight of the airplane is not on the main landing gear (power is from the primary bus and is routed through ground safety relay No. 2). Power is available to the pilot's stick button only when the ARM MASTER switch is positioned to "ON" with the landing gear handle in the "UP" position or the GROUND FIRING CONTROL switch is momentarily actuated when the landing gear handle is in the "DOWN" position (power is from the armament bus). (See figure 7-6.)

7-161. TROUBLE SHOOTING BOMBING SYSTEM.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: All stores removed from wings.
Airplane placed on jacks or ground safety switch linkage disconnected.
28-volt d-c external power applied to airplane.
STORES & TANK JETTISON, STORES JETTISON & DROP TANK TRANSFER and EXTERNAL STORES & EMERGENCY RELEASE circuit breakers engaged.
STORE & TANK JETTISON button in closed position.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.			
Defective STORES & TANK RELEASE relay.	Check test points ARA, ARB, ARC, ARD, ARE, ARF and ARG to ground.	28 volts dc at test point ARA and zero volts at all or any of test points ARB, ARC, ARD, ARE, ARF and ARG.	Replace defective relay.
		Zero volts at test point ARA.	Refer to probable cause, "Defective STORES & TANK JETTISON Relay and Power Source Through the Relay."
Defective STORES & TANK JETTISON relay and power source through the relay.	Check test point ARH to ground.	28 volts dc.	Replace defective wire segment between test points ARA and ARH.
		Zero volts.	Continue trouble shooting.
	Place jumper between test points ARK and ARM. Check test points ARJ to ground and ARN to ground.	28 volts dc at both test points ARJ and ARN.	Replace defective relay or associated wiring.
		Other than 28 volts dc at test point ARN.	Refer to probable cause, "Defective STORES & TANK JETTISON Relay Control Circuit."
		Other than 28 volts dc at test point ARJ.	Continue trouble shooting.
	Check test point ARL to ground.	28 volts dc.	Replace defective circuit breaker.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
Defective STORES & TANK JETTISON relay control circuit.	Check test point ARL to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
	Check test point ARM to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Replace defective circuit breaker, STORE & TANK JETTISON button or wire segment between test points ARL and ARM.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON. (Cont)			
Defective STORES & TANK JETTISON relay control circuit. (Cont)	Place jumper between test points ARK and ARM. Check test point ARN to ground.	28 volts dc.	Replace STORES & TANK JETTISON relay.
		Zero volts.	Refer to probable cause, "Defective GROUND SAFETY RELAY NO. 2 or Defective Associated Wiring."
Defective GROUND SAFETY RELAY NO. 2 or defective associated wiring.	Check between test point CPC and ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Replace defective power wire.
	Check between test points GM and GDE.	28 volts dc.	Replace defective GROUND SAFETY RELAY NO. 2.
	Note Test point GM is positive.	Zero volts.	Continue trouble shooting.
	Check between test point GM and ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Replace defective power wire.
	Check between test point GDE and ground.	Zero ohms.	Replace defective GROUND SAFETY RELAY NO. 2.
		Other than zero ohms.	Refer to paragraph 3-102, Trouble Shooting Landing Gear System.
EXTERNAL STORES FAIL TO JETTISON FROM AERO 15B OR AERO 15C COMBINATION BOMB RACK AND ROCKET LAUNCHER AT ANY SINGLE STATION OR COMBINATION OTHER THAN ALL STATIONS.			
Defective permanent or package wire between STORES & TANK RELEASE relay and bomb rack release mechanism.	Check test point ARB, ARC, ARD, ARE, ARF or ARG to ground as applicable.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to trouble, ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.
	Check test point AXA, AXB, AXC or AXG, as applicable, to ground.	28 volts dc.	Replace defective primer or rack.
		Zero volts.	Perform continuity check between applicable test point AXA, AXB, AXC or AXG and corresponding test point ARB, ARC, ARD, ARE, ARF or ARG and repair or replace defective wire.
EXTERNAL STORES FAIL TO JETTISON FROM UNIVERSAL PYLON STATION 2.			
Defective permanent or package wire between STORES & TANK RELEASE relay and bomb rack release mechanism.	Check test point ARF to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to trouble, ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.
	Check test point AXD to ground.	28 volts dc.	Replace Aero 7A rack or primer.
		Zero volts.	Perform continuity check between test points ARF and AXD and replace defective wire as necessary.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
EXTERNAL STORES FAIL TO JETTISON FROM UNIVERSAL PYLON STATION 5.			
Defective permanent or package wire between STORES & TANK RE-LEASE relay and bomb rack release mechanism.	Check test point ARC to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to trouble, ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.
	Check test point AXE to ground.	28 volts dc.	Replace Aero 7A rack or primer.
		Zero volts.	Perform continuity check between test points ARC and AXE and replace defective wire as necessary.
150-GALLON TANK FAILS TO JETTISON—STATION 1 OR 6.			
Defective permanent or package wire between STORES & TANK RE-LEASE relay and tank release mechanism.	Check test point ARB or ARG to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to trouble, ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.
	Check test point AXF, right- or left-hand as required, to ground.	28 volts dc.	Replace primer or Aero 7A rack.
		Zero volts.	Perform continuity check between test points AXF and ARB or ARG as required and replace defective wire segment.
200-GALLON DROP TANK FAILS TO JETTISON FROM STATION 2 OR 5 BY ACTUATION OF STORE & TANK JETTISON BUTTON.			
Defective tank release solenoid circuit.	Check test point AXJ or AXK to ground.	28 volts dc.	Replace defective tank release solenoid.
		Zero volts.	Continue trouble shooting.
	Check test point ARC or ARF to ground as necessary.	28 volts dc.	Perform continuity check between test points ARC or ARF (as applicable) and AXJ or AXK and replace defective wire segment.
		Zero volts.	Refer to trouble, ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: EXTERNAL STORES & EMERGENCY RELEASE circuit breaker engaged.
External stores emergency release switch maintained in closed position.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
EXTERNAL STORE ON STATION 1, 3, 4 OR 6 FAILS TO RELEASE UPON ACTUATING JET EXTL STORES HANDLE.			
Defective STORES & TANK RELEASE relay and control circuit.	Check test points ARA, ARB, ARD, ARE and ARG to ground.	28 volts dc at test point ARA and other than 28 volts dc at any of the other test points.	Replace defective relay.
		Zero volts at test point ARA.	Continue trouble shooting.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
EXTERNAL STORE ON STATION 1, 3, 4 OR 6 FAILS TO RELEASE UPON ACTUATING JET EXTL STORES HANDLE. (Cont)			
Defective STORES & TANK RELEASE relay and control circuit. (Cont)	Check test point ARP.	28 volts dc.	Perform continuity check between test points ARP and ARA and replace defective circuit breaker, external stores emergency release switch or wire segment.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: All external stores removed.
28-volt d-c external power applied to airplane.
Armament bus energized.
MODE SELECT switch in "BOMBS & TANKS" position.
BOMB & GUN TRIGGER, MODE SELECT & BOMB ARM, BOMB & ROCKET FIRE STA 1 & 6, BOMB & ROCKET FIRE STA 2 & 5 and BOMB & ROCKET FIRE STA 3 & 4 circuit breakers engaged.
Bomb button actuated momentarily for meter readings.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL EXTERNAL STORES FAIL TO RELEASE WITH STATION SELECTOR POSITIONED TO "SALVO."			
Defective SALVO RELAY solenoid or control circuit.	Check test point ART to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to paragraph 7-7, Trouble Shooting Gunnery System; probable cause, "No Power to Armament Bus."
	Place MODE SELECT switch to "BOMBS & TANKS" and STATION SELECTOR switch to "SALVO." Check test point ARQ to ground.	28 volts dc.	Replace external stores relay box.
		Zero volts.	Continue trouble shooting.
	Perform continuity check between test points ARR and ARQ.	Zero ohms.	Continue trouble shooting.
		Other than zero ohms.	Replace defective wire segment between test points ARR and ARQ.
	Check test point ARS to ground.	28 volts dc.	Replace defective bomb and rocket system control box.
		Zero volts.	Perform continuity check between test points ARS and ART and replace defective circuit breaker, wire segment or bomb button as necessary.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
EXTERNAL STORE AT STATION 1, 2, 3, 4, 5 OR 6 FAILS TO RELEASE WITH STATION SELECTOR IN "PAIRS" POSITION.			
Failure of BOMB & ROCKET FIRING relay control circuit.	**Note** For failure to release from station 1, 2 or 3, refer to trouble, External Store Fails to Release with Station Selector in "SINGLES" Position.		
	For station 4, 5 or 6, perform continuity check between test points AZ2 and AZ3, AZ4 or AZ5 with STATION SELECTOR at proper position.	Zero ohms.	Continue trouble shooting.
		Other than zero ohms.	Replace defective bomb and rocket system control box.
	Perform continuity check between test points AZG and AZN; AZH and AZP; AZJ and AZQ.	Zero ohms.	Refer to trouble, EXTERNAL STORE FAILS TO RELEASE WITH STATION SELECTOR IN "SINGLES" POSITION.
		Other than zero ohms.	Replace defective jumper wire as necessary.
EXTERNAL STORE FAILS TO RELEASE WITH STATION SELECTOR IN "SINGLES" POSITION.			
Defective release mechanism.	Check test point AXL, AXM, AXN, AXQ, AXR, AXS or AXT to ground (for other than 200-gallon drop tank).	28 volts dc.	Replace defective primer or rack.
		Zero volts.	Refer to probable cause, "Defective Permanent or Package Wiring Between BOMB & ROCKET FIRING Relay and Release Mechanism."
	For 200-gallon tank installation, use test point AXJ or AXK to ground.	28 volts dc.	Replace defective tank release solenoid.
		Zero volts.	Check TANK RELEASE switch for improper position or continuity and refer to probable cause, "Defective Permanent or Package Wiring Between BOMB AND ROCKET FIRING Relay and Release Mechanism."
Defective permanent or package wiring between BOMB & ROCKET FIRING relay and release mechanism.	Check test point ARU, ARV, ARW, ARX, ARY or ARZ to ground.	28 volts dc.	Perform continuity check between following test points as required and repair as necessary: ARU and AXL or AXR; ARV and AXJ, AXK, AXM or AXS; ARW and AXQ; ARX and AXQ; ARY and AXJ, AXK, AXM, AXN or AXT; ARZ and AXL or AXR.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
EXTERNAL STORE FAILS TO RELEASE WITH STATION SELECTOR IN "SINGLES" POSITION. (Cont)			
Defective permanent or package wiring between BOMB & ROCKET FIRING relay and release mechanism. (Cont)	Check test point ARU, ARV, ARW, ARX, ARY or ARZ to ground.	Zero volts.	Refer to probable cause, "Defective BOMB & ROCKET FIRING Relay or Control Circuit."
Defective BOMB & ROCKET FIRING relay or control circuit.	Check following test points, as required, to ground: ARU and AZA, ARV and AZB, ARW and AZC, ARX and AZD, ARY and AZE, ARZ and AZF.	28 volts dc at test point AZA, AZB, AZC, AZD, AZE or AZF. Zero volts at test point ARU, ARV, ARW, ARX, ARY or ARZ.	Replace defective relay.
		Zero volts at test point AZA, AZB, AZC, AZD, AZE or AZF.	Continue trouble shooting.
	Remove bomb and rocket system control box from center pedestal assembly and perform continuity check between test points AR2 and AR3, AR4, AR5, AR6, AR7 or AR8 with STATION SELECTOR at same position being checked.	Zero ohms.	Perform continuity check between test points AZF and AZG, AZE and AZH, AZD and AZJ, AZC and AZK, AZB and AZL, AZA and AZM; repair or replace defective wire segment.
		Other than zero ohms.	Replace bomb and rocket system control box.
STATION SELECTOR FAILS TO ADVANCE AUTOMATICALLY.			
Defective station advance solenoid or control circuit.	Check test point AZR to ground.	28 volts dc.	Replace bomb and rocket system control box.
		Zero volts.	Continue trouble shooting.
	Perform continuity check between test points AZR and AZS and AZT and AZU.	Zero ohms.	Replace bomb and rocket system control box.
		Other than zero ohms.	Replace defective wire segment.

7-162. OPERATIONAL CHECK OF BOMBING SYSTEM.

7-163. Prior to any bombing mission, a thorough ground check of the bombing system should be performed. Check the bombing system as follows:

a. Check bomb racks and adapter beams for security of attachment and safetying. Ejection cartridges should not be installed in Aero 7A bomb rack breeches prior to bomb loading.

b. Check operation of the Aero 15B or Aero 15C bomb racks as follows: (1) Rotate latching handle and close bomb hooks manually. (2) Position d-c power switch to "OFF." Connect external electrical power to airplane, energize the armament bus and engage all bombing system circuit breakers. Position MODE SELECT

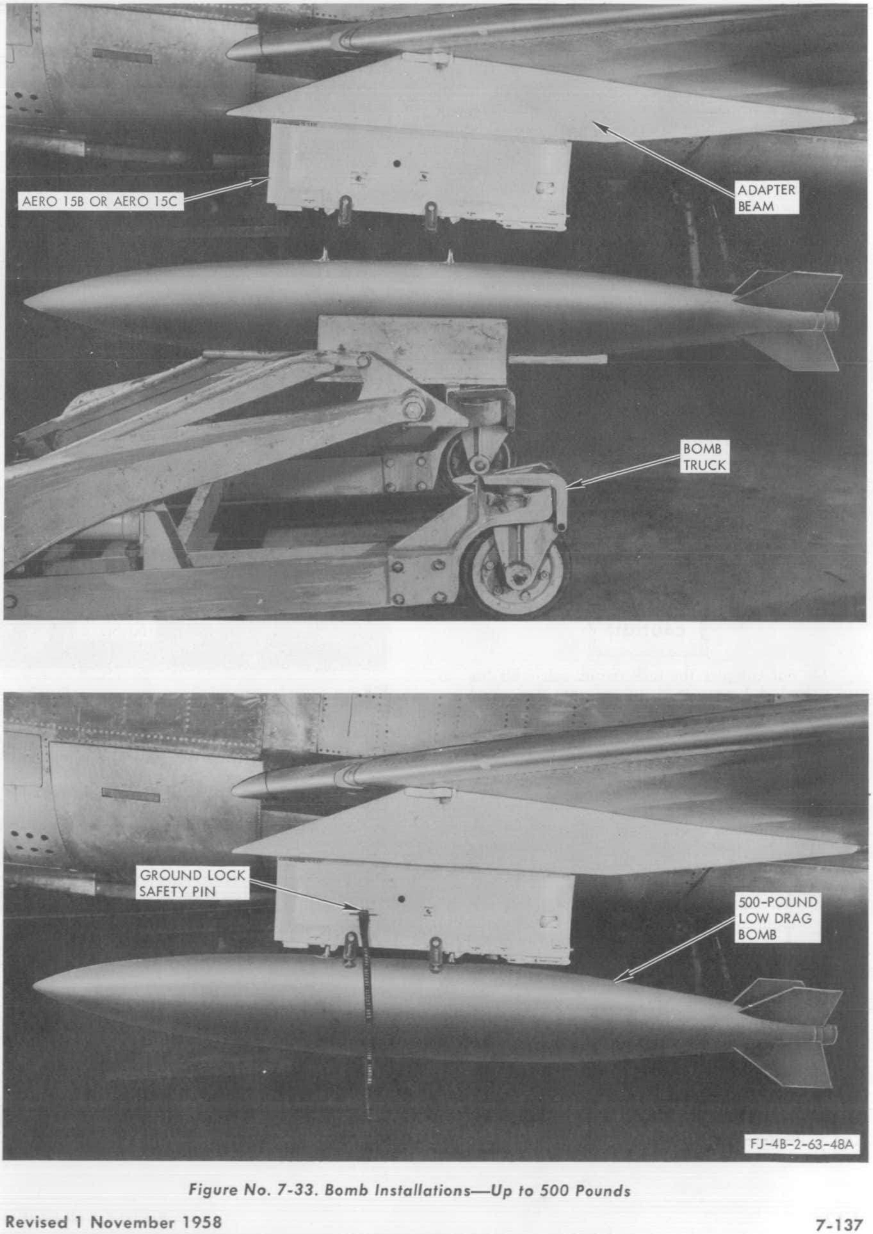


Figure No. 7-33. Bomb Installations—Up to 500 Pounds

switch to "BOMBS & TANKS." Position STATION SELECTOR switch to "SALVO." (3) Place arming wire loops in the nose and tail arming units of each bomb-rocket rack. Position bomb ARMING switch to "NOSE & TAIL" and depress bomb-rocket release button. The arming loops should be held firmly by arming solenoids. Position bomb ARMING switch to "TAIL ONLY" and depress bomb-rocket release button. Nose arming wire loops can be pulled out and tail arming wire loops should be retained in the rack. (4) Re-cock racks and replace arming wire loops in arming units. Position bomb ARMING switch to "SAFE" and depress the bomb-rocket release button. All arming wire loops can be pulled out. (5) Cock racks and position STATION SELECTOR switch to "1." Depress bomb-rocket release button six times in succession. The racks should trip in the following order: left-hand outboard, right-hand outboard, left-hand mid station, right-hand mid station, left-hand inboard and right-hand inboard. (6) Cock racks and position STATION SELECTOR switch to "1-6." Depress bomb-rocket release button three times in succession. The racks should trip in pairs in the following order: right- and left-hand outboard and right- and left-hand mid station and right- and left-hand inboard. (7) Cock racks and position STATION SELECTOR switch to "SALVO." Depress bomb-rocket release button. All racks should trip simultaneously. (8) Repeat steps (5) through (7) with dummy bombs or weights of not less than 25 pounds suspended from bomb-rocket racks. Dummy bombs or weights should drop in correct sequence.

CAUTION

Do not energize the rack release solenoids for a period longer than 30 seconds. Prolonged actuation will burn out the coil windings.

(9) Remove external electrical power from airplane, position all armament switches to "OFF" and pull all bombing system circuit breakers.

c. Check operation of the Aero 7A ejector bomb racks as follows: (1) Manually close bomb rack hooks. (2) Visually check alignment of black line inside cover of spring housing assembly with black lines on window. When hooks are fully latched, lines will be aligned. (3) Rotate manual release knob counterclockwise. All hooks should open. (4) Check position of guide to breech caps. If guide is not behind back of caps, caps are not sufficiently tight to provide satisfactory electrical contact.

Note

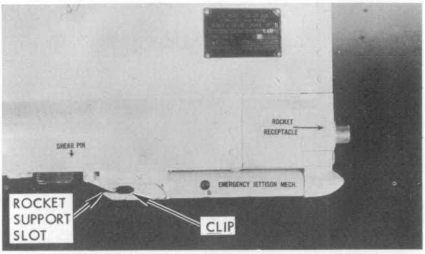
Check electrical power to breeches with a meter.

(5) Check electrical operation of nose and tail arming solenoids by following steps (2) through (4) listed in preceding step b. (6) Remove external electrical power from airplane, position all armament switches to "OFF" and pull all bombing system circuit breakers.

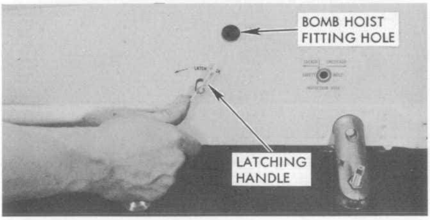
7-164. LOADING BOMBS UP TO 500 POUNDS.

1 Install correct adapter beam and Aero 15B or Aero 15C for selected station. (Refer to paragraph 7-152.)

2 Insert a clip in rear rocket support slot at forward end of emergency jettison mechanism. Check piston, "O" ring and lead coil in gun.



3 If Mark 8 bomb hoist is to be used, attach hoist fittings to Aero 15B or Aero 15C.

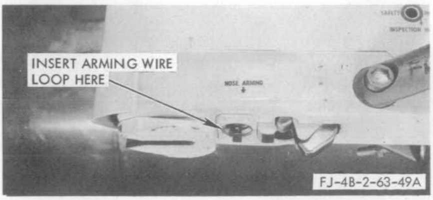


4 Turn rack latching handle fully counterclockwise.

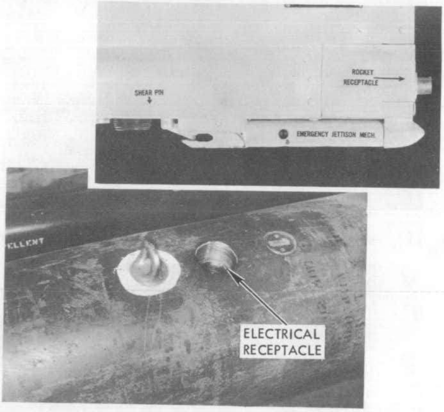
Note Make certain sway brace pads are screwed up out of the way to avoid binding against the store

5 Raise bomb to rack with Mark 8 bomb hoists or bomb truck and force bomb lugs up into rack hooks. Hooks will snap into locked position. Insert ground lock safety pin. Remove bomb hoists or truck.

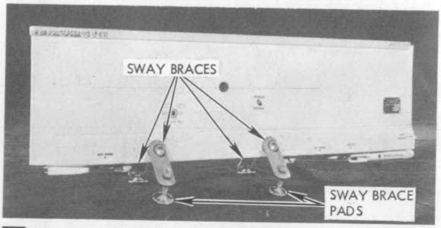
6 Insert nose and tail arming wire loops into their respective arming units on underside of bomb rack. Make certain loops are inserted far enough to be retained by arming units.



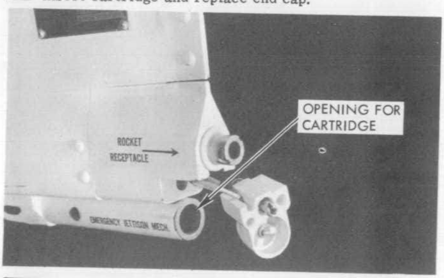
7 If streamline bomb, with electrical fuzing, is being installed, bomb arming wire is not used. Make electrical connection from connector forward of shear pin on bomb rack to well in bomb just aft of forward lug.



8 Lower sway brace pads until they touch store surface. Tighten pads alternately by rotating each one-fourth turn. Again tighten pads alternately by rotating each one-fourth turn for total of one-half turn.



9 Remove end cap from emergency jettison mechanism, insert cartridge and replace end cap.



10 If used, remove bomb hoist fitting from Aero 15B or Aero 15C.

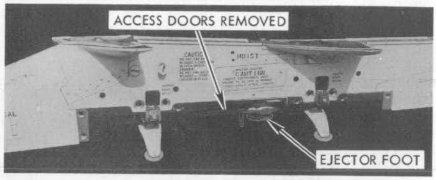
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7-165. LOADING BOMBS OVER 500 POUNDS.

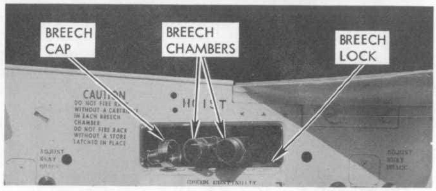
Note Bombs weighing over 500 pounds are hung on the universal pylon in the "UP" position at mid stations only. (Refer to paragraph 7-155.)

1 Deleted

2 Screw ejector foot up into bomb rack far enough to prevent interference with store loading.



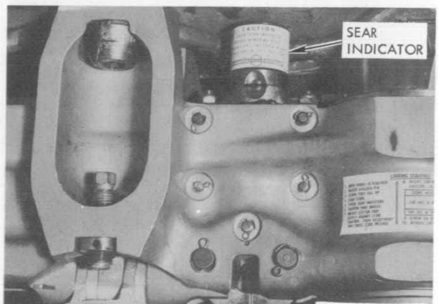
3 Disconnect breech caps from breech chambers.



4 Attach bomb hoist fittings to pylon.

5 Raise bomb to pylon with Mark 8 bomb hoists or bomb truck until bomb lugs enter rack hooks and force them closed.

6 Visually check sear indicators to ensure that hooks are properly latched and install ground safety pin.

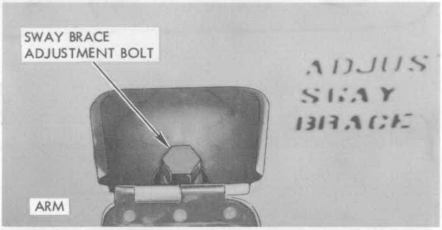


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7 Remove bomb hoists, bomb hoisting bands and hoist fitting if used.

8 Insert arming wire loops in nose and tail arming solenoids at each end of bomb rack and through nose and tail arming fuzes.

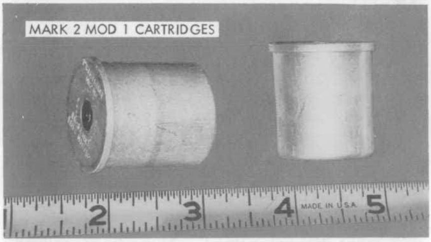
9 Turn four sway brace adjustment bolts until sway braces touch store surface. Tighten sway braces by rotating adjustment bolts one-fourth turn each. Again, tighten sway braces by rotating adjustment bolts one-fourth turn for total of one-half turn.



10 Screw ejector foot down until light contact is made with bomb.

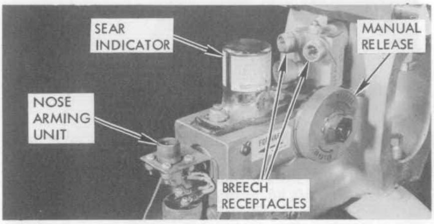
Caution If ejector foot is screwed down too tightly, store release can occur.

11 Place two Mark 2 Mod 0 or Mod 1 cartridges into breech chambers.



12 Connect breech caps to breech chambers.

13 Deleted



14 Replace pylon access doors.

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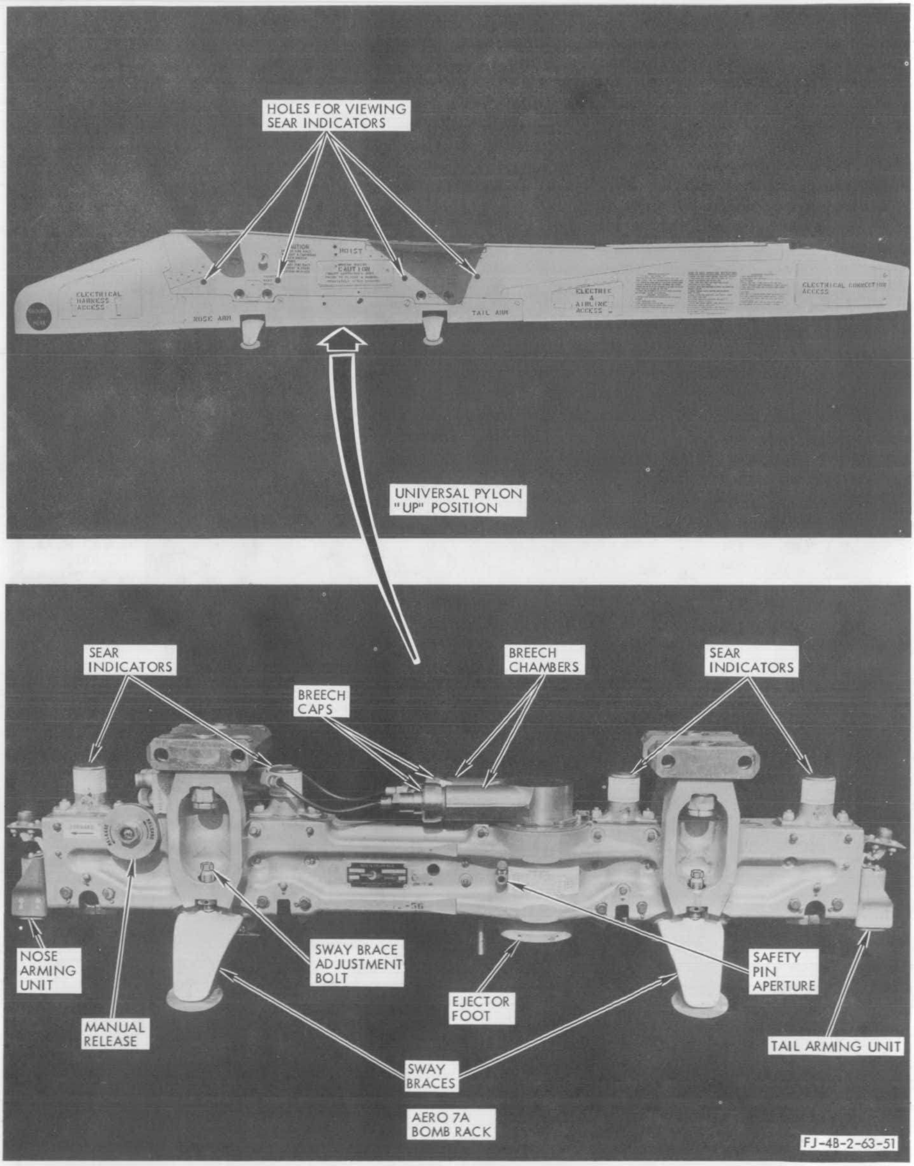
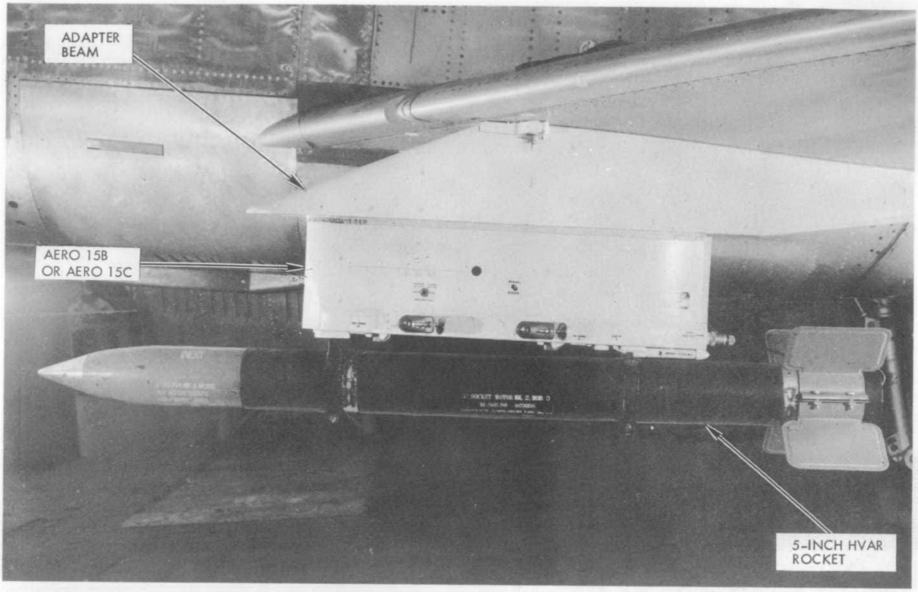


Figure No. 7-34. Bomb Installations—Over 500 Pounds



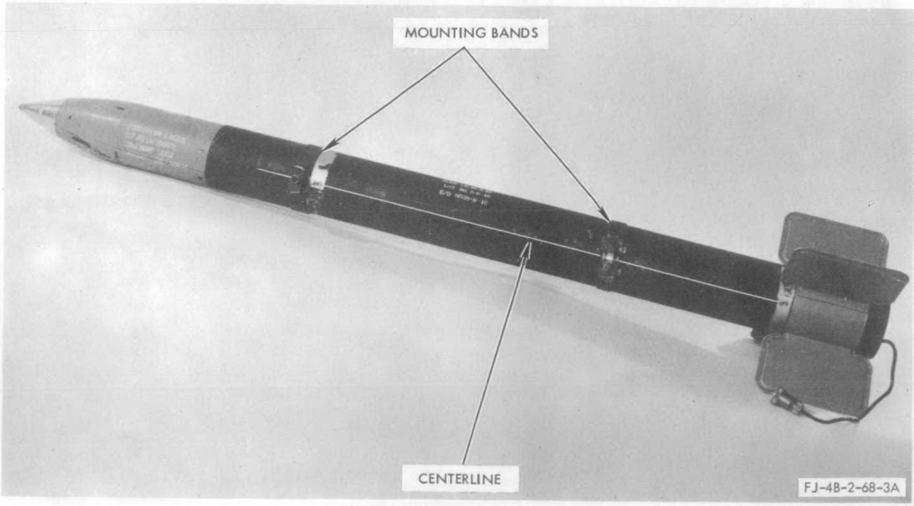


Figure No. 7-35. Rocket Installations

ROCKET SYSTEM

7-166. ROCKET SYSTEM.

7-167. The installation of equipment contained in the various 209-63202 packages prepares the airplane's six wing stations for receiving a variety of external stores. With the appropriate equipment installed, capabilities for rockets are as follows: rockets at all stations, except for the Aero 10D series rocket pods which are not carried inboard. The installation of adapter beams and Aero 15B or Aero 15C bomb-rocket racks equips the six stations to carry rockets and/or rocket pods. The six underwing stations will accommodate a 5-inch HVA rocket at each station or a rocket pod at each station. Aero 6A-1 series rocket pods, containing seven 2.75-inch rockets, Aero 7D series rocket pods, containing nineteen 2.75-inch rockets, or Aero 10D series rocket pods, containing four 5-inch HVA rockets, can be utilized. Rockets can be carried in conjunction with bombs and/or auxiliary fuel tanks as long as the combination is symmetrical. In addition, the TANK—BOMB & ROCKET microswitch on the mid station adapter beam rear fairing must be previously positioned in accordance with the type of store to be carried. (Refer to paragraph 7-150.) The rocket pods and 5-inch HVA rockets can be fired by single stations or by paired stations, or they can be salvoed simultaneously. Target tracking is accomplished through the aircraft fire control system. (Refer to paragraph 7-196.) The rockets can be jettisoned through either of two emergency jettison systems.

CAUTION

The external stores emergency release circuit breakers should be disengaged when the airplane is on the ground, to prevent unintentional jettisoning of external stores.

7-168. FUNCTION OF ROCKET SYSTEM.

7-169. Rocket control is accomplished through the bomb and rocket system control box installed in the center pedestal. (See figure 7-32.) Included on the control box is a station selector switch (STATION SELECTOR) and a mode selector switch (MODE SELECT). To fire the rockets, the circuit breakers (ARMAMENT BUS, BOMB & GUN TRIGGER, MODE SELECT & BOMB ARM, BOMB & ROCKET FIRE STA 3 & 4, BOMB & ROCKET FIRE STA 2 & 5, BOMB & ROCKET FIRE STA 1 & 6, STORES & TANK JETTISON, STORES JETTISON & DROP TANK TRANSFER and EXTERNAL STORES & EMERGENCY RELEASE) must be engaged. Position the ARM MASTER switch to "ON" and set the MODE SELECT switch to "ROCKETS & MISSILES." To fire the rockets or rocket pods by single stations, position the STATION SELECTOR switch to "1" and depress the bomb-rocket release button. Electrical power is routed through the release button switch, the mode selector switch, the selected contact of the station selector switch and through the firing and armament selector relays to station No. 1 bomb-rocket rack rocket-firing circuit. (See figure 7-22.) When the bomb-rocket release button is released, the station selector advance solenoid is de-energized, automatically advancing the station selector switch to the next station in sequence. The station selector switch will advance each time the release button is depressed and released until the rockets at all six stations have been fired. To fire the rockets by paired stations, initially position the STATION SELECTOR switch to "1-6." Stations one and six will then fire when the bomb-rocket release button is depressed. When the release button is released, the STATION SELECTOR switch will then advance to station "2-5." The station selector switch will continue to advance automatically until the rockets have been fired from all stations. To salvo the rockets from all stations, manually position the STATION SELECTOR switch to "SALVO." Depressing the bomb-rocket release button then routes electrical power to the salvo relay to energize the relay and to route power to the rocket-firing circuits of each of the Aero 15B or Aero 15C bomb-rocket racks. The full complement of rockets will be fired simultaneously. When rocket pods are being fired singly, or in pairs, the entire pod at the selected station will fire out when the bomb-rocket release button is depressed, except the Aero 10D pod which fires single rockets or ripple fire, according to the type of firing selected when the pod is installed. Positioning the station selector switch to any station or pair of stations containing pods and depressing the bomb-rocket release button routes electrical power to an integral intervalometer in the pod or pods selected. The intervalometer spaces and controls the firing of the rockets in the pod at 10-millisecond intervals until the pod has fired out. Each pod is equipped with an intervalometer. The first rocket fired from the rocket pod blows both the nose and tail fairing free of the pod assembly. After the rocket pod or pods have been fired out, they can be released by positioning the MODE SELECT switch to "BOMBS & TANKS," positioning the station selector switch to the desired station and depressing the bomb-rocket release button. Electrical power is then routed through the station selector switch contact to the rack release solenoids at the station or stations selected, dropping the expended pod or pods. The rockets or rocket pods can be jettisoned from all stations by pressing the STORE & TANK JETTISON button or by pulling the JET EXTL STORES handle. Power is available to the external stores emergency release switch (actuated by the JET EXTL STORES handle) any time the battery is installed. The airplane generator can also supply power to the switch through the primary bus when the D.C. POWER switch is in the "BAT. & GEN" position. The STORE & TANK JETTISON button operates only when the weight of the airplane is not on the main landing gear (power is from the primary bus and is routed through ground safety relay No. 2). Power is available to the pilot's stick button only when the ARM MASTER switch is positioned to "ON" with the landing gear handle in the "UP" position or the GROUND FIRING CONTROL switch momentarily actuated when landing gear handle is in the "DOWN" position (power is from the armament bus). (See figure 7-6.)

7-170. TROUBLE SHOOTING ROCKET SYSTEM.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: All stores removed from wings.
Airplane placed on jacks or ground safety switch linkage disconnected.
28-volt d-c external power applied to airplane.
STORES & TANK JETTISON, STORES JETTISON & DROP TANK TRANSFER and EXTERNAL STORES & EMERGENCY RELEASE circuit breakers engaged.
STORE & TANK JETTISON button actuated momentarily for meter readings.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.			
Defective STORES & TANK RELEASE relay.	Check test points ARA, ARB, ARC, ARD, ARE, ARF and ARG to ground.	28 volts dc at test point ARA. Zero volts at all or any of test points ARB, ARC, ARD, ARE, ARF and ARG.	Replace defective relay.
		Zero volts at test point ARA.	Refer to probable cause, "Defective STORES & TANK JETTISON Relay and Power Source Through the Relay."
Defective STORES & TANK JETTISON relay and power source through the relay.	Check test point ARH to ground.	28 volts dc.	Replace defective wire segment between test points ARA and ARH.
		Zero volts.	Continue trouble shooting.
	Place jumper between test points ARK and ARM. Check test points ARJ and ARN to ground.	28 volts dc at both test points ARJ and ARN.	Replace defective relay or associated wiring.
		Other than 28 volts dc at test point ARN.	Refer to probable cause, "Defective STORES & TANK JETTISON Relay Control Circuit."
		Other than 28 volts dc at test point ARJ.	Continue trouble shooting.
	Check test point ARL to ground.	28 volts dc.	Replace defective circuit breaker.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
Defective STORES & TANK JETTISON relay control circuit.	Check test point ARM to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Replace defective circuit breaker, STORE & TANK JETTISON button or wire segment between test points ARL and ARM.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON. (Cont)			
Defective STORES & TANK JETTISON relay control circuit. (Cont)	Place jumper between test points ARK and ARM. Check test point ARM to ground.	28 volts dc.	Replace STORES & TANK JETTISON relay.
		Zero volts.	Refer to probable cause, "Defective GROUND SAFETY RELAY NO. 2 or Defective Associated Wiring."
Defective GROUND SAFETY RELAY NO. 2 or defective associated wiring.	Check between test point CPC and ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Replace defective power wire.
	Check between test points GM and GDE. Note: Test point GM is positive.	28 volts dc.	Replace defective GROUND SAFETY RELAY NO. 2.
		Zero volts.	Continue trouble shooting.
	Check between test point GM and ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Replace defective power wire.
	Check between test point GDE and ground.	Zero ohms.	Replace defective GROUND SAFETY RELAY NO. 2.
		Other than zero ohms.	Refer to paragraph 3-102, Trouble Shooting Landing Gear System.
EXTERNAL STORES FAIL TO JETTISON FROM AERO 15B OR AERO 15C COMBINATION BOMB RACK AND ROCKET LAUNCHER AT ANY SINGLE STATION OR COMBINATION OTHER THAN ALL STATIONS.			
Defective permanent or package wire between STORES & TANK RELEASE relay and bomb rack release mechanism.	Check test point ARB, ARC, ARD, ARE, ARF or ARG to ground as applicable.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to trouble, EXTERNAL STORES FAIL TO JETTISON BY ACTUATING STORE & TANK JETTISON BUTTON.
	Check test point AXA, AXB, AXC or AXG, as applicable, to ground.	28 volts dc.	Replace defective primer or rack.
		Zero volts.	Perform continuity check between applicable test point AXA, AXB, AXC or AXG and corresponding test point ARB, ARC, ARD, ARE, ARF or ARG. Repair or replace defective wire.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: EXTERNAL STORES & EMERGENCY RELEASE circuit breaker engaged.
External stores emergency release switch maintained in closed position.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ROCKETS ON ALL STATIONS FAIL TO JETTISON UPON ACTUATING JET EXTL STORES HANDLE.			
Defective STORES & TANK RELEASE relay and control circuit.	Check test points ARA, ARB, ARC, ARD, ARE and ARG to ground.	28 volts dc at test point ARA and other than 28 volts dc at any of the other test points.	Replace defective relay.
		Zero volts at test point ARA.	Continue trouble shooting.
	Check test point ARP.	28 volts dc.	Perform continuity check between test points ARP and ARA and replace defective circuit breaker, external stores emergency release switch or wire segment.
		Zero volts.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.

TEST EQUIPMENT: D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: All external stores removed.
28-volt d-c external power applied to airplane.
Armament bus energized.
MODE SELECT switch positioned to "ROCKETS & MISSILES."
BOMB & GUN TRIGGER, MODE SELECT & BOMB ARM, BOMB & ROCKET FIRE STA 1 & 6, BOMB & ROCKET FIRE STA 2 & 5 and BOMB & ROCKET FIRE STA 3 & 4 circuit breakers engaged.
Bomb button actuated momentarily for meter readings.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL ROCKETS FAIL TO FIRE WITH STATION SELECTOR POSITIONED TO "SALVO."			
Defective ARM. SEL. RELAY.	Check test point ASA.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to probable cause, "Defective ARM. SEL. RELAY Control Circuit."
	Check test points ARU, ARV, ARW, ARX, ARY and ARZ to ground.	28 volts dc.	Replace defective ARM. SEL. RELAY.
		Zero volts.	Refer to probable cause, "Defective SALVO RELAY or Control Circuit."
Defective ARM. SEL. RELAY control circuit.	Check test point ASB to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Perform continuity check between test points ASB and ASC. Replace defective wire segment or circuit breaker.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ALL ROCKETS FAIL TO FIRE WITH STATION SELECTOR POSITIONED TO "SALVO." (Cont)			
Defective ARM. SEL. RELAY control circuit. (Cont)	Perform continuity check between test points AZ6 and AZ7.	Zero ohms.	Continue trouble shooting.
		Other than zero ohms.	Replace defective bomb and rocket system control box.
	Check test point ASA to ground.	28 volts dc.	Refer to probable cause, "Defective ARM. SEL. RELAY."
		Zero volts.	Perform wire continuity check between test point ASA and the bomb and rocket control box. Replace defective wire as necessary.
Defective SALVO RELAY or control circuit.	Check test point ART to ground.	28 volts dc.	Continue trouble shooting.
		Zero volts.	Refer to paragraph 7-7, Trouble Shooting Gunnery System; probable cause, "No Power to Armament Bus."
	Place STATION SELECTOR switch to "SALVO." Check test point ARQ to ground.	28 volts dc.	Replace defective SALVO RELAY.
		Zero volts.	Continue trouble shooting.
	Perform continuity check between test points ARR and ARQ.	Zero ohms.	Continue trouble shooting.
		Other than zero ohms.	Replace defective wire segment between test points ARR and ARQ.
	Check test point ARS to ground.	28 volts dc.	Replace defective bomb and rocket system control box.
		Zero volts.	Perform continuity check between test points ARS and ART. Replace defective circuit breaker, wire segment or bomb button as necessary.
ROCKETS AT STATION 1, 2, 3, 4, 5 OR 6 FAIL TO FIRE WITH STATION SELECTOR SWITCH IN "PAIRS" POSITION.			
Failure of BOMB & ROCKET FIRING relay control circuit.	**Note** For failure to fire from station 1, 2 or 3, refer to trouble, ROCKET FAILS TO FIRE WITH STATION SELECTOR IN "SINGLES" POSITION. For station 4, 5 or 6, perform continuity check from test points AZ2 to AZ3, AZ4 or AZ5 with STATION SELECTOR at proper position.	Zero ohms.	Continue trouble shooting.
		Other than zero ohms.	Replace defective bomb and rocket system control box.
	Perform continuity check between test points AZG and AZN; AZH and AZP; AZJ and AZQ.	Zero ohms.	Refer to trouble, ROCKET FAILS TO FIRE WITH STATION SELECTOR IN "SINGLES" POSITION.
		Other than zero ohms.	Replace defective jumper wire as necessary.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
ROCKET FAILS TO FIRE WITH STATION SELECTOR IN "SINGLES" POSITION.			
Defective Aero 15B or Aero 15C combination bomb rack and rocket launcher.	Check test points AXU, AXW, AXY and AXX to ground.	28 volts dc.	Replace defective rack.
		Zero volts.	Refer to probable cause, "Defective Permanent or Package Wiring Between BOMB & ROCKET FIRING Relay and Aero 15B or Aero 15C Combination Bomb Rack and Rocket Launcher."
Defective permanent or package wiring between BOMB & ROCKET FIRING relay and Aero 15B combination bomb rack and rocket launcher.	Check test point ARU, ARV, ARW, ARX, ARY or ARZ to ground.	28 volts dc.	Perform continuity check between following test points as required and replace defective ARM. SEL. RELAY or wire as necessary: ARU and AXU; ARV and AXX or AXY; ARW and AXW; ARX and AXW; ARY and AXX or AXY; ARZ and AXU.
		Zero volts.	Refer to probable cause, "Defective BOMB & ROCKET FIRING Relay or Control Circuit."
Defective BOMB & ROCKET FIRING relay or control circuit.	Check following test points, as required, to ground: ARU and AZA, ARV and AZB, ARW and AZC, ARX and AZD, ARY and AZE, ARZ and AZF.	28 volts dc at test point AZA, AZB, AZC, AZD, AZE or AZF. Zero volts at test point ARU, ARV, ARW, ARX, ARY or ARZ.	Replace defective relay.
		Zero volts at test point AZA, AZB, AZC, AZD, AZE or AZF.	Continue trouble shooting.
	Remove bomb and rocket system control box from center pedestal assembly and perform continuity check between test points AR2 and AR3, AR4, AR5, AR6, AR7 or AR8 with STATION SELECTOR at same position being checked.	Zero ohms.	Perform continuity check between test points AZF and AZG; AZE and AZH; AZD and AZJ; AZC and AZK; AZB and AZL; AZA and AZM. Repair or replace defective wire segment.
		Other than zero ohms.	Replace bomb and rocket system control box.
STATION SELECTOR FAILS TO ADVANCE AUTOMATICALLY.			
Defective station advance solenoid or control circuit.	Check test point AZR to ground.	28 volts dc.	Replace bomb and rocket system control box.
		Zero volts.	Continue trouble shooting.
	Perform continuity check between test points AZR and AZS and AZT and AZU.	Zero ohms.	Replace bomb and rocket system control box.
		Other than zero ohms.	Replace defective wire segment.

7-171. CHECKING ROCKET SYSTEM.

7-172. Prior to any rocket-carrying mission, a thorough ground check of the rocket system should be accomplished. These checks include rocket preloading check, circuit continuity check and rocket squib check. Due to the nature of the rocket system, these checks must be performed at definite intervals during the loading procedure.

WARNING

The rocket preloading check is performed before the Aero 15B or Aero 15C racks are installed on the airplane. The circuit continuity check is accomplished after the Aero 15B or Aero 15C racks are installed, but before rockets are loaded. The rocket squib check is performed after 5-inch HVA rockets are loaded and shipping caps are removed, but before the igniter plugs are plugged into the rocket receptacle.

7-173. ROCKET PRELOADING CHECK. To accomplish the rocket preloading checks, proceed as follows:

a. Position d-c power switch to "OFF." Connect an external 28-volt d-c electrical power source to airplane's external power receptacle. Energize armament bus by momentarily depressing ground firing control switch on test switch panel and positioning ARM MASTER switch to "ON."

b. Engage rocket system circuit breakers and position STATION SELECTOR switch to "1." Depress bomb-rocket release button and check for presence of 28 volts dc at pin socket "A" of left-hand outboard bomb-rocket rack connector plug. Make identical checks at positions "6," "2," "5," "3" and "4" on STATION SELECTOR switch for right-hand outboard, left-hand mid station, right-hand mid station, left-hand inboard and right-hand inboard stations, respectively.

c. Position STATION SELECTOR switch to "1-6," depress bomb-rocket release button and check for presence of 28 volts dc at pin socket "A" of both outboard bomb-rocket rack connector plugs. Position STATION SELECTOR switch to "2-5" and then "3-4" and make identical checks at mid station and inboard stations, respectively.

d. Position STATION SELECTOR switch to "SALVO," depress bomb-rocket release button and check for presence of 28 volts dc at pin socket "A" of all bomb-rocket rack connector plugs.

e. Pull JET EXTL STORES handle and check for presence of 28 volts dc at pin socket "L" of all bomb-rocket connector plugs. Depress STORE & TANK JETTISON button and make identical voltage check at all stations.

f. Place all armament switches in "OFF" position and disconnect external power from airplane. Pull all rocket system circuit breakers before attempting to load rockets.

7-174. ROCKET CIRCUIT CONTINUITY CHECK. This check is accomplished before installation of rocket stores utilizing the rocket circuit connector plug at the aft end of the Aero 15B or Aero 15C bomb-rocket racks. To perform the rocket circuit continuity check, proceed as follows:

a. Connect a 28-volt d-c external power source to airplane's external power receptacle. Energize armament bus and engage all rocket system circuit breakers.

b. Connect numbered test leads from a B-2 tester (Specification 24971-A) into electrical receptacle at aft end of Aero 15B or Aero 15C racks. Start with left-hand outboard Aero 15B or Aero 15C rack and progress across to right-hand side in the following test lead number sequence: 1, 3, 5, 6, 4 and 2.

c. Position STATION SELECTOR switch to "1" and depress bomb-rocket release button nine times in succession. The indicator lights on the tester should illuminate in sequence singly, one through six, and in pairs, 1-6, 2-5, 3-4, with the action of the bomb-rocket release button.

d. Position STATION SELECTOR switch to "SALVO" and depress bomb-rocket release button. Indicator lights one through six should illuminate simultaneously. Disconnect tester leads.

CAUTION

Any malfunction that causes a light to fail to illuminate, or to illuminate out of order, however momentary, must be investigated and corrected before rocket loading is continued.

e. Check bomb release system for correct operation so that expended rocket pods can be jettisoned. (Refer to paragraph 7-162.)

f. Remove external electrical power from airplane's electrical system, position all armament system switches to "OFF" and pull all rocket system circuit breakers.

7-175. ROCKET SQUIB CHECK. The rocket squib check is accomplished on 5-inch HVA rockets after the rockets have been loaded and the shipping caps removed. After the shipping caps have been removed and before the rocket igniter leads are plugged in, make a rocket squib check with a Type 680A rocket squib tester. The rocket squibs should be checked by one man, working from one side of the airplane to the other. Each individual rocket should be checked with the squib tester.

CAUTION

Hold squib tester at arms length while testing each rocket.

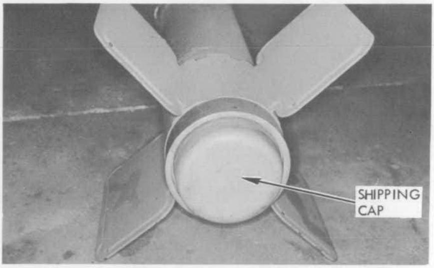
If rocket does not check properly on tester, unload and replace rocket with one of known quality.

7-176. LOADING ROCKETS.

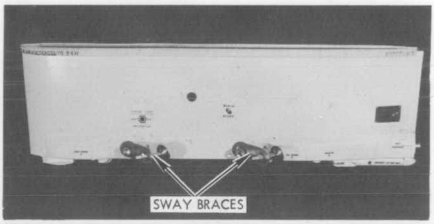
1 Loosen rocket mounting bands. Move aft mounting band back until band projections coincide with notches on forward side of fin assembly sleeve. With projections engaged, mark a centerline down center of rocket using aft tunnel lug as a reference point.

2 Move aft mounting band forward until tunnel lug is 20-1/2 inches forward of aft edge of fin assemblies. Center tunnel lug on rocket centerline and tighten mounting band. Move center mounting band back against aft band, rotate button mount 90 degrees to side of rocket and tighten band.

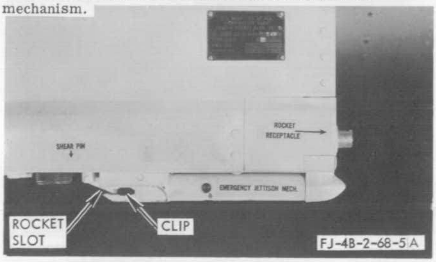
3 Remove shipping cap from aft end of rocket.



4 Sway braces must be repositioned to face aft if they are positioned down. (Refer to paragraph 7-152.)



5 If installed, remove clip from Aero 15B or Aero 15C rocket slot just forward of emergency jettison mechanism.



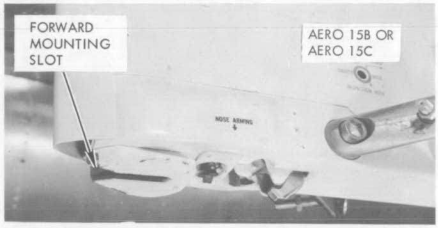
Caution

Before loading rockets, insert screwdriver in the "ROCKET CONTACT" access hole, (Aero 15B or Aero 15C) and turn forward shaft clockwise and aft shaft counterclockwise. This positions both rocket contacts in the up position. If the contacts are down, the rocket firing circuit would be grounded out.

6 Raise rocket to rack inserting aft lug into rocket slot on Aero 15B or Aero 15C.

7 Slide rocket forward mounting band back on rocket, inserting button mount on band in mounting slot at forward end of rack.

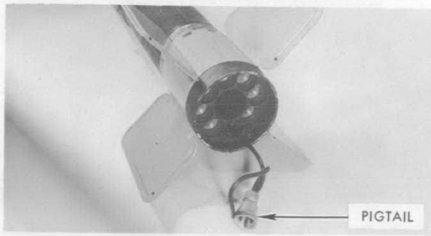
8 Slide forward mounting band as far back on rocket as possible, fully engaging button mount with mounting slot. Tighten mounting band.

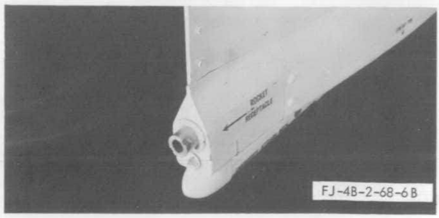


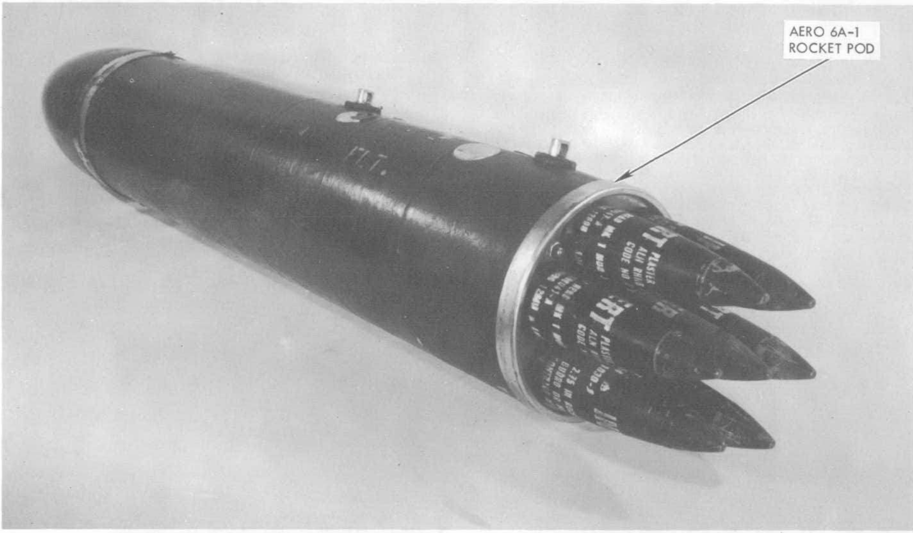
9 Perform rocket squib test. (Refer to paragraph 7-175.)

10 Connect rocket pigtail to electrical receptacle at rear of bomb rack in accordance with local directives.

11 Check adjustment of rocket contacts not in contact with HVAR body.







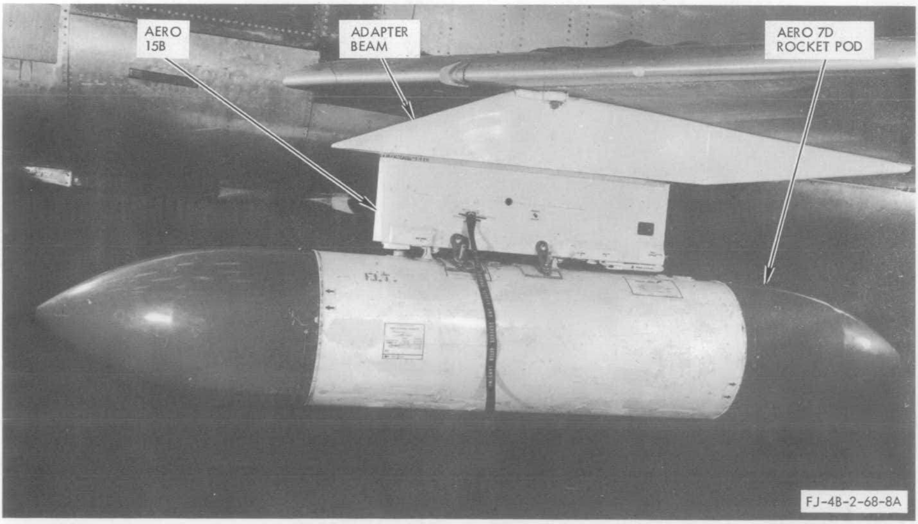


Figure No. 7-36. Rocket Pod Installations

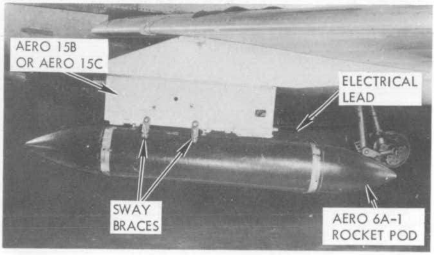
7-177. LOADING ROCKET PODS.

LOADING AERO 6A-1 ROCKET POD

1 Raise rocket pod to bomb-rocket rack and engage pod lugs with rack hooks.

2 Rotate latching handle on side of rack fully clockwise and apply force to bottom of rack hooks. A screwdriver can be used to help pull the hooks closed by laying the screwdriver across the heel of the hook and drawing forward with both hands.

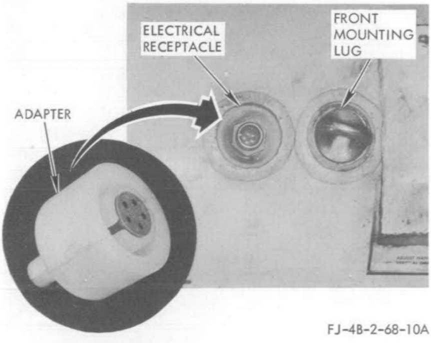
3 Lower sway brace pads until they touch store surface. Tighten pads alternately by rotating each one-fourth turn. Again, tighten pads alternately by rotating each one-fourth turn for total of one-half turn.



4 Connect plug on electrical lead emerging from rocket pod aft fairing to electrical receptacle at rear of bomb-rocket rack.

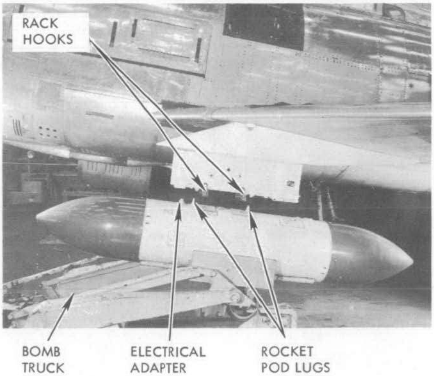
LOADING AERO 7D ROCKET POD

1 Insert electrical connection adapter into receptacle just forward of rocket pod front mounting lug.

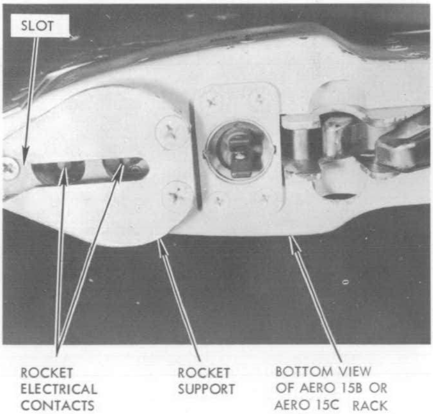


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2 Raise rocket pod to bomb-rocket rack and engage pod lugs with rack hooks.



Note When raising rocket pod, care must be taken to guide the electrical adapter into the slot of the rocket support at the forward end of the rack.

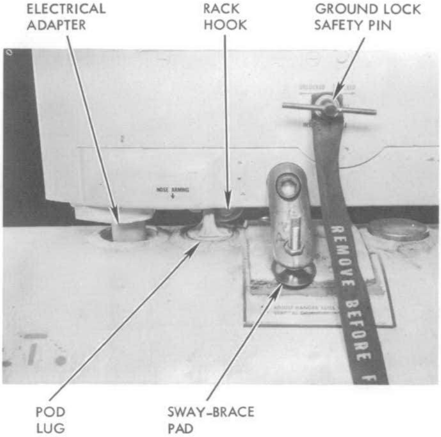


3 Lock rack hooks by turning latching handle on rack and forcing pod lugs up against top of hooks.

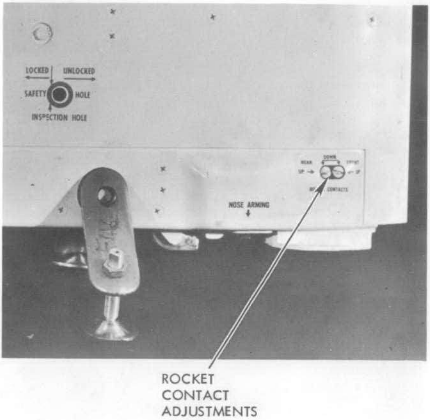
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4 Insert ground lock safety pin.

5 Lower sway-brace pads until they touch store surfaces. Tighten pads alternately by rotating each one-fourth turn. Again, tighten pads alternately by rotating each one-fourth turn for total of one-half turn.



6 Adjustment of rocket contacts to touch electrical adapter can be made at forward end of bomb-rocket rack, right-hand side.



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MISSILES

7-178. MISSILES.

7-179. The airplane is capable of carrying various missiles. The Sidewinder missile (paragraph 7-180) can be carried at all six external store stations. [For further missile information, refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).]

7-180. SIDEWINDER.

7-181. The Sidewinder is a passive, infra-red, homing air-to-air guided missile. It is 5 inches in diameter, 108 inches long, weighs 164 pounds and has a successful range of 3500 yards at an altitude of 5000 feet, 6000 yards at an altitude of 40,000 feet and 7000 yards at an altitude of 50,000 feet. The Sidewinder requires no guidance radar or fire control system, the only aiming device necessary being the fixed reticle image of the gun sight unit. The airplane's six external store stations are capable of accommodating Sidewinder missiles, three under each wing. Each station is equipped with an Aero 3A pylon and launcher. (Refer to paragraph 7-153.) Sidewinder d-c power is furnished by the monitored bus through three circuit breakers located on the right-hand rear vertical console. The 115-volt, 400-cycle, a-c power is supplied from the a-c secondary bus through three 2-ampere fuses located on the right-hand rear vertical console. Sidewinder control is accomplished through the external stores control box installed in the center pedestal. Included on the bomb-rocket control box or external stores control box is the Sidewinder audio volume control, the mode selector switch (MODE SELECT) and the station selector switch (STATION SELECTOR). The Sidewinder is fired by depressing the bomb-rocket release button on the control stick grip.

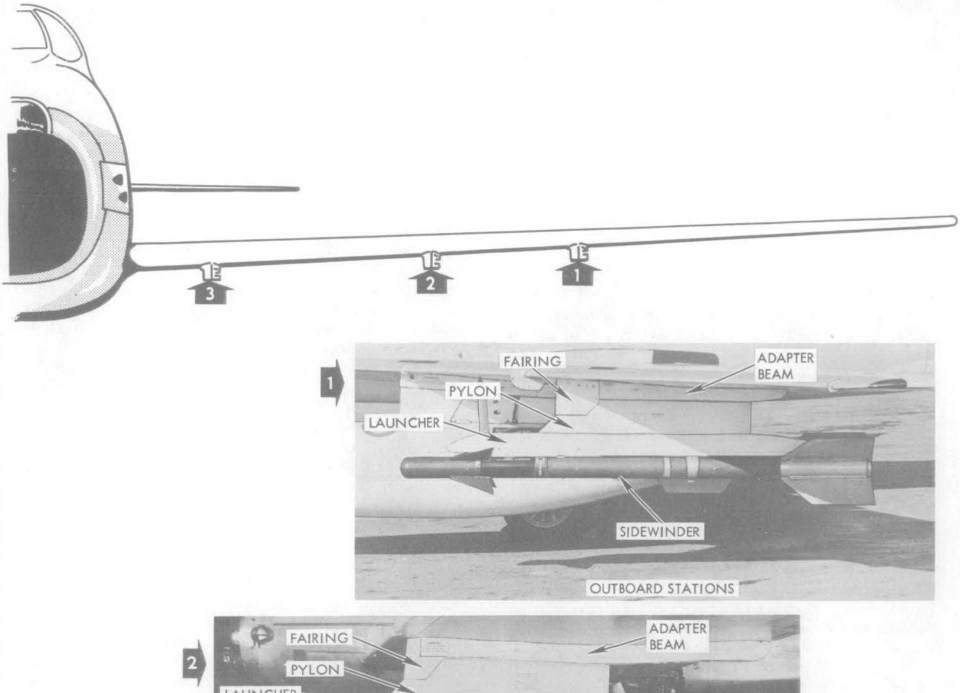
7-182. FUNCTION OF SIDEWINDER SYSTEM.

7-183. The Sidewinder is controlled through the external stores control box in the center pedestal and is fired through actuation of the bomb-rocket release button on the control stick grip. (See figure 7-38.) To fire the Sidewinder, engage all Sidewinder system circuit breakers and position the ARM MASTER switch to "ON." Position the MODE SELECT switch to "ROCKETS & MISSILES" and position the station selector switch to the desired station. Actuation of the bomb-rocket release button will then route electrical power to the launcher and through the umbilical connector to the missile, thus firing the gas generator grain. The gas generator grain is a slow burning, double-base propellant compound contained in a small canister set between the fin pistons. Gas from this burning compound is led through orifices to exert pressure on the fin pistons and is led through another orifice to a turbine which powers a generator. As electrical power from this generator reaches a sufficient frequency and voltage (usually within 0.75 second), a relay in the launcher power supply closes to send airplane system electrical power to the launcher striker points. Electrical power is routed across the launcher striker points to energize the influence fuze and to energize the rocket motor squib, thus firing the missile. The Sidewinder will not fire normally as a controlled missile until there is sufficient internal electrical power to ensure that all guidance components are working properly. In the event that electrical power from the generator cannot operate the firing relay, the generator will burn out after approximately 11 seconds and the rocket motor will not fire. A by-pass circuit is provided for emergency jettisoning, enabling the missile to be fired as a non-guided rocket. When the Sidewinder is jettisoned, the rocket motor is fired directly without setting off the gas generator grain. The optical system which provides the signal for Sidewinder control is designed to be influenced by infra-red energy. The Sidewinder looks at its target through a hemispherical window at the forward end of the missile. This dome is of heavy glass and is bonded to the seeker head case. The dome is covered with a protective cap until just prior to take-off. The optical mechanism within the forward end of the missile is arranged so as to function as a rotating gyroscope. (See figure 7-37.) The forward section is a shallow cup with the bottom facing forward. The walls of the cup are flanged and painted a dull black to prevent radiation from extraneous sources being reflected into the optical system to confuse the seeker. A glass disk with two concentric channels inside is bonded on the outside bottom surface of the cup. These channels are partially filled with mercury-thallium mixture to provide stability for the gyro and to damp any small disturbances which might cause the gyro to mutate.

CAUTION

Mercury-thallium mixture is highly toxic and damaged heads should be handled with extreme care. Thallium will penetrate unbroken skin and may cause blindness if it comes in contact with the eyes.

The gyro is rotated by the motor drive coils in the plastic head coil assembly. These coils exert a torque on a magnet mounted on the back of the primary mirror assembly. The magnet and the coil assembly thus act as a hysteresis motor to turn the gyro assembly at 70 cycles per second. Current for rotation is applied only while the missile is on the launcher. At time of firing, electrical power to the motor drive coils is cut off and the gyro coasts until interception is made with the target. The primary mirror and magnet are mounted



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Figure No. 7-37. Sidewinder Missile (Sheet 1)

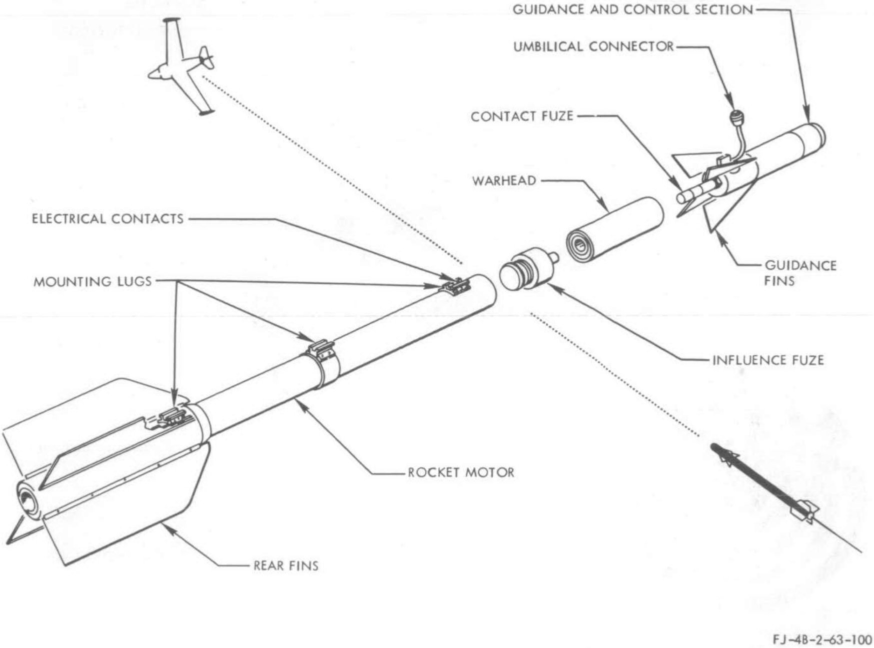


Figure No. 7-37. Sidewinder Missile (Sheet 2)

on the base of a non-reflecting hollow tube which is a part of and supports the entire rotating gyro section. A spherical ball attached at the axis of the seeker head serves as the support of the rotating gyro assembly which rotates on a double-ball track. (See figure 7-37.) The supporting mechanism allows the gyro to spin in an arc of 40 degrees full angle cone, centered on the missile axis. Infra-red energy coming through the forward hemispherical window strikes the primary mirror and is focused toward a secondary mirror. The secondary mirror reflects the rays into the interior of the hollow tube. A rotating reticle is mounted in the tube at the focus on the optical system. The flat circular reticle is so designed that it contains alternate clear and opaque surfaces on half of the surface while the other half is semi-transparent. The reticle rotates with the gyro system so that the transparent sections move past the off-center target image focused on the face of the reticle. Each time the off-center target image and a clear space on the reticle coincide, a pulse of light is transmitted to the surface of a lead sulphide photo cell behind the reticle. The lead sulphide photo cell transmits an electrical signal corresponding in amplitude to the amount of the target image contained in the transparent sector of the reticle. If the whole target image is contained within the transparent sector, the amplitude of the photo cell signal will be at a maximum. As the target image moves toward the center of the reticle, it is no longer fully displayed in the transparent sector and the photo cell signal will be correspondingly less in amplitude. The signal from the photo cell is amplified by a seven-tube electronic amplifier unit and is sent through to the precession solenoid coils surrounding the primary mirror and magnet. Current in these coils acts on the rotating magnet in such a direction as to keep the gyro-telescope centered on the target. At the same time, current is generated by the rotating magnet in a set of four reference coils surrounding the precession coils. Differences between the phase of the current in the reference coils and that which is passing through the precession coils determine the target position in respect to the missile body. The amplitude of the precession current determines the rate

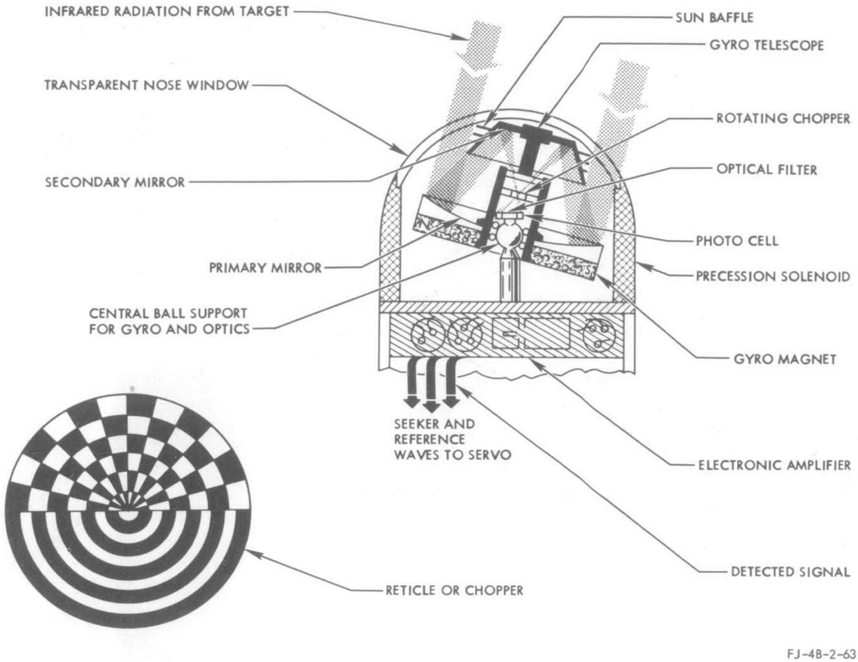


Figure No. 7-38. Sidewinder Optical System

at which the missile must turn in order to intercept the target. This signal is amplified and sent to the four control vane servos to determine the missile flight path. The Sidewinder is steered in flight by two pairs of movable fins. Each pair is fixed to a shaft which is rotated by two gas-operated pistons. The four operating pistons fit into four cylinders in the servo block. Gas pressure from the gas generator grain enters the cylinders through orifices in the forward end. Solenoid-controlled flapper valves in the rear end of the pistons act to control the escape of gas from the cylinders. As electrical current to a solenoid is increased, the force with which the flapper valve is held closed against gas pressure is proportionally increased. As the electrical current to one solenoid is increased, a proportional decrease in electrical current is commanded to the other solenoid of the pair, allowing one of the paired pistons to exert push against the fin shaft while the other piston exerts pull against the shaft. The two pistons working together exert a turning movement on the fin shaft, turning the pair of fins attached to the shaft. The torque exerted on the shaft by the movement of the pistons continues until it is balanced by the torque exerted by moving air against the fins. Since the fins are torque-operated, the missile compensates automatically for altitude and airspeed. While the missile is on the launcher, the fins are allowed to ride free in the air stream. A disabling circuit prevents commands from reaching the servos until after the missile leaves the launcher and gas pressure is on the pistons. The trailing and outer edges of the guidance fins are grooved to contain actuating wires for the contact fuze. These wires are crushed on contact with the target and provide a ground for the fuze electrical circuit. A primer is initiated which sets off the firing train in the rotor, initiating the booster charge and firing the warhead.

7-184. AERO 3A SIDEWINDER PYLON.

7-185. The Aero 3A Sidewinder pylon, from which the Sidewinder launcher is suspended, is a sheet metal fairing around a rigid machined aluminum support. Two chamfered studs extend up through the support to attach to the external stores adapter beam which is used to support both the pylon and the launcher. Two mount fittings are incorporated in the lower side of the pylon

for use in attaching the launcher. The pylon electrical cable mates with the adapter beam electrical connector at the upper side of the pylon and mates with the launcher power supply receptacle at the lower side. The pylon electrical cable is not secured at the lower end so that it may be attached to the launcher power supply receptacle before the launcher is placed in position on the pylon.

7-186. AERO 3A SIDEWINDER LAUNCHER.

7-187. The Aero 3A Sidewinder launcher (paragraph 7-153) is suspended from the pylon by means of two internal wrenching head mounting studs. The launcher is designed to carry the missile on three lugs which slide in the launcher rail. Three slots are provided in the bottom of the rail to accommodate the missile lugs during loading. When the missile is loaded on the launcher, the forward missile lug is held between the two fingers of a restraining detent, preventing any longitudinal travel of the missile on the launcher. Two spring-loaded snubber bars over the forward lug and two bars over the aft lug wedge firmly in place to prevent any swaying of the missile. Between the fingers of the detent are located two spring-loaded strikers which contact the missile electrical contact buttons when the missile is in place. A heavy spring backs the forward detent so that a forward missile acceleration of 9 to 10 G is required to effect missile release. An inertia lock is provided to prevent inadvertent missile release in case of heavy airplane deceleration. The 20- to 25-G missile acceleration, occurring in normal missile firing, is sufficient to override the detent and release the missile for flight. The nose section of the launcher is hinged to swing upward, exposing the umbilical block hook and retainer. The missile umbilical electrical cable connects to an electrical receptacle in the nose of the launcher and enters the missile through the umbilical block. The missile umbilical block, which must shear when the missile is fired, is held by the spring-loaded umbilical block hook. When the missile is fired and the umbilical block shears free, the block hook immediately carries the block and attached electrical wiring up into the launcher nose, clear of the missile path. The launcher contains a power supply which provides both stand-by and firing power to the missile. The stand-by a-c and d-c power is controlled by an interlock ground which is supplied by the missile. Each wing station supplies its own ground. When the missile is fired, the stand-by power is removed from the station. The launcher power supply obtains 115-volt a-c and 28-volt d-c electrical power from the airplane's electrical system and furnishes the necessary electrical power requirements to the missile components. An amplifier in the launcher power supply provides the amplified missile signal to the pilot's earphones. The launcher incorporates provisions for the use of target rockets and electrically ignited flares. The target rocket and flare ignition circuits from the launcher power supply terminate in two electrical receptacles on the aft end of the launcher. The firing line from the launcher power supply to the rear striker pin, which fires the missile motor, is interrupted by a safety switch mounted in the launcher. The safety switch is opened by inserting a ground safety pin through the ground safety hole just aft of the launcher nose cap.

7-188. INSTALLING AND REMOVING MISSILE PYLON AND LAUNCHER. Refer to paragraph 7-153.

7-189. SIDEWINDER SYSTEM OPERATIONAL TESTS USING AERO X5A TEST SET.

7-190. The Aero X5A armament test set is a self-contained unit which is installed on the Sidewinder launcher rail in a position similar to that of the loaded missile. Electrical contact buttons on the test set contact the launcher striker pins and an umbilical electrical cable on the test set attaches to the launcher umbilical receptacle. The test set obtains electrical power from the same sources that supply power to the missile, thus simulating actual missile operation. The test set functions to determine that both stand-by and firing electrical power being supplied to the missile are within voltage tolerances, that the missile firing sequence is operating satisfactorily and that the firing circuits are safe after testing. Initial operation of the test set requires a 10-second delay initiated by a time delay relay to allow the launcher power supply to reach steady state operation. Two test modes are provided. The short mode indicates that missile stand-by power supplied by the launcher is within required tolerances and that the firing circuits are safe. The long mode includes all short mode tests plus an operational test of the missile firing circuits. To perform the short mode test, proceed as follows:

a. Insert ground safety pin in launcher.

b. Install Aero X5A test set on launcher rail and position to engage test set lug with launcher detents. Connect test set umbilical electrical cable to umbilical receptacle in launcher nose.

c. Position ARM MASTER switch to "OFF," MODE SELECT switch to "OFF" and station selector switch to the station being tested. The man in the cockpit should have on earphones.

d. Apply 28-volt d-c electrical ground power to airplane's electrical system.

e. Check the test set. Test lights 1 through 11 and the NO light will be illuminated. After a 10-second warm-up period, the test set will cycle through the testing sequence and stop with lights 1 through 8 out, lights 9, 10 and 11 illuminated, NO light out and GO light illuminated. In addition, the man in the cockpit will hear a tone in the earphones.

f. If the test set does not complete the testing sequence, observe where the sequence has stopped. The first numbered light still illuminated will indicate the

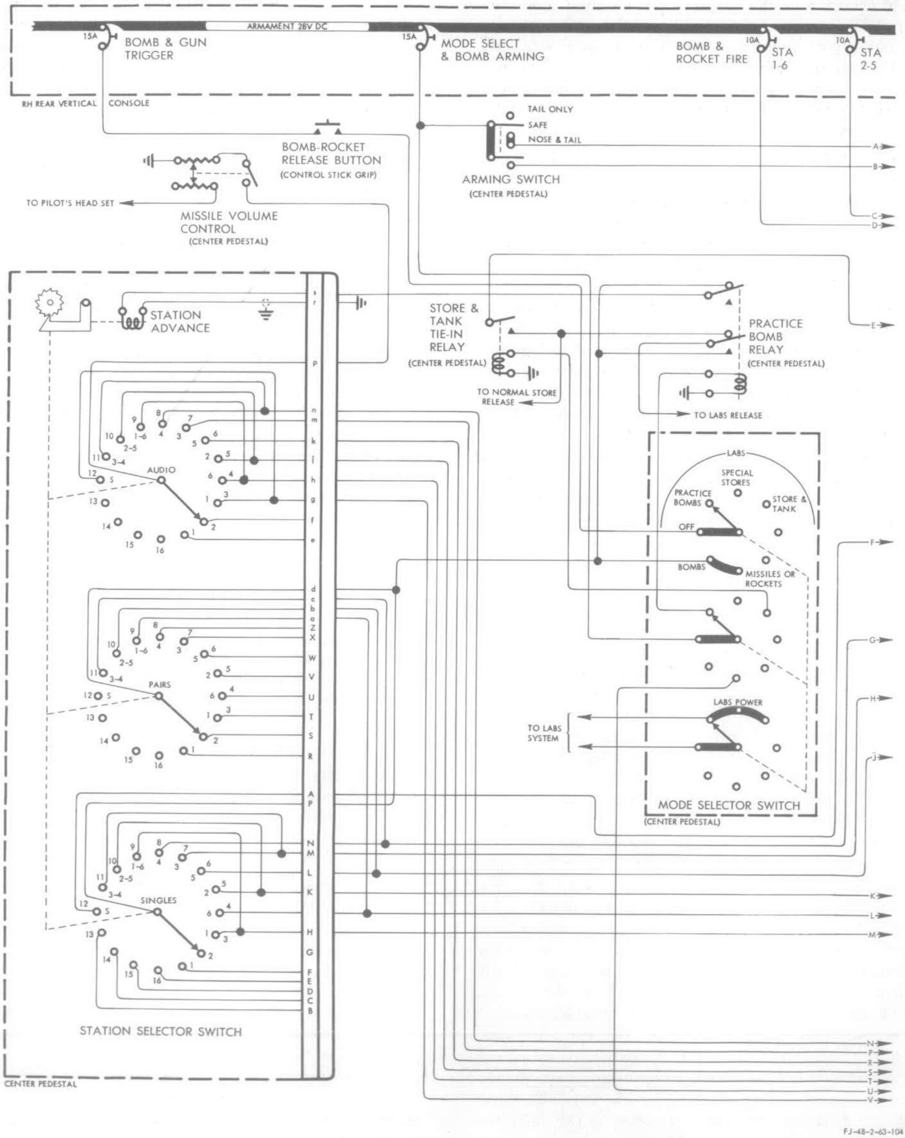


Figure No. 7-39. Sidewinder System (Sheet 1)

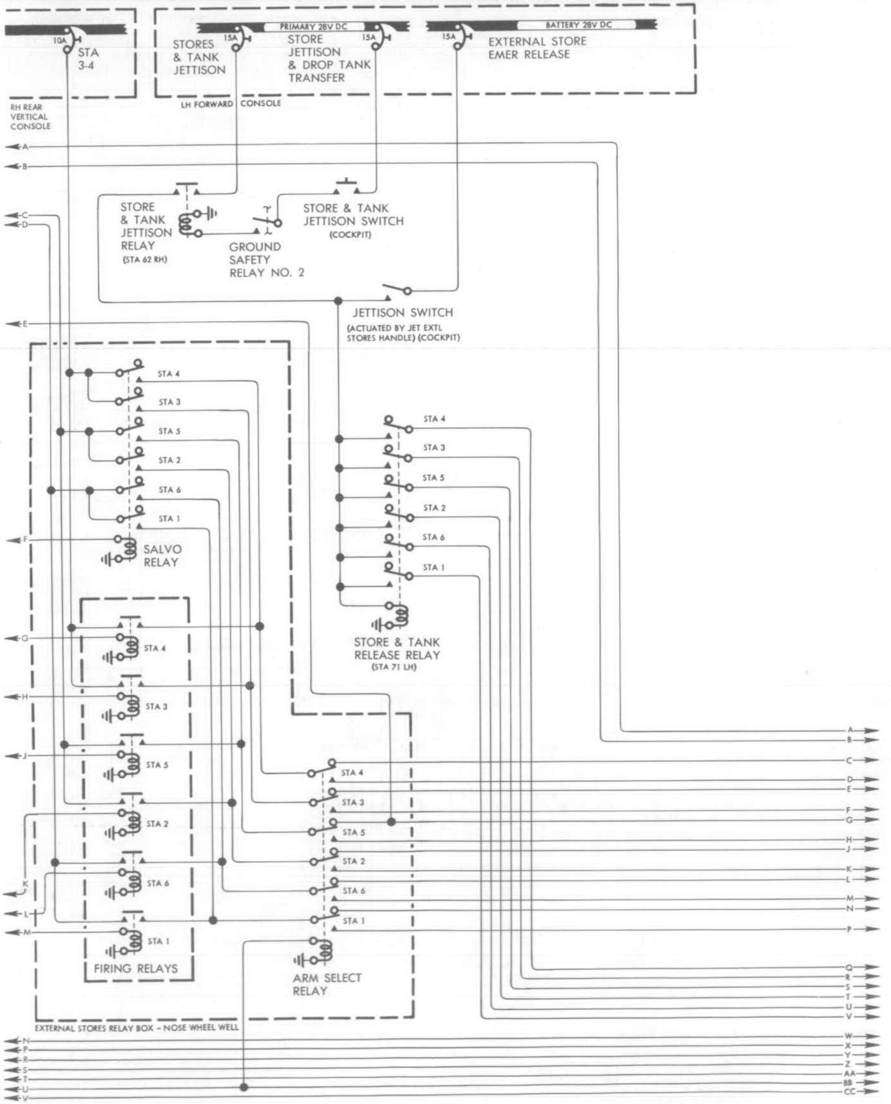


Figure No. 7-39. Sidewinder System (Sheet 2)

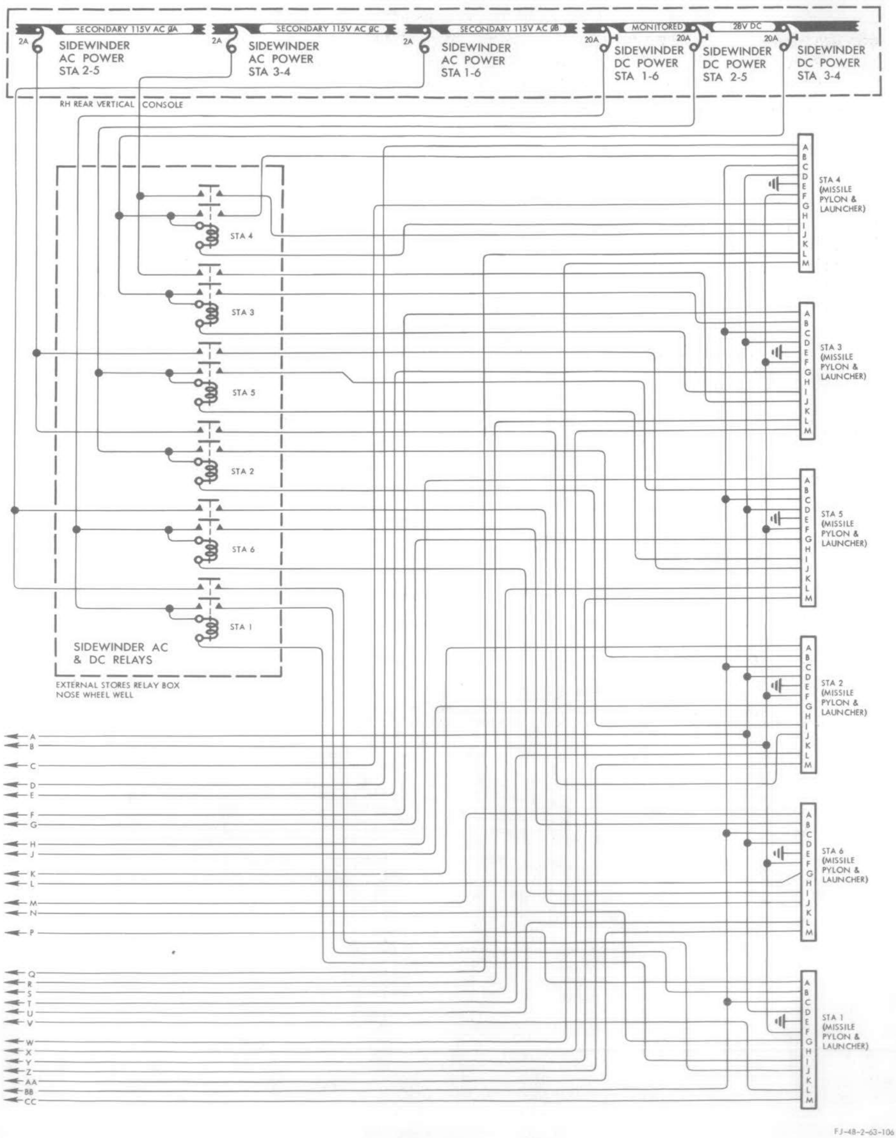


Figure No. 7-39. Sidewinder System (Sheet 3)

launcher function not operating properly. The functions and their associated numbers are as follows:

LIGHT	FUNCTION
1	Precession amplifier filaments
2	Motor drive filaments
3	Precession amplifier
4	Motor drive
5	Disabling
6	Servo heater power
7	Spare
8	Electrical caging operation

g. The test should be reaccomplished with a second Aero X5A test set if the test set used first is suspected of malfunctioning. If both test sets indicate the same malfunction, checks should be made to determine whether the launcher power supply or the launcher and airplane wiring are at fault. The test should be reaccomplished after repair or replacement is completed.

h. After the test set indicates proper functioning of the launcher and airplane components, connect a rocket launcher firing circuit tester to the receptacle provided on the Aero X5A test set.

i. Remove ground safety pin from launcher.

j. Make a stray voltage test, using the 30- and 1.5-volt scales.

k. Install ground safety pin in launcher.

l. Remove ground electrical power from airplane's electrical system. Make certain all armament switches in the cockpit are positioned to "OFF."

m. Remove rocket launcher firing circuit tester and Aero X5A test unit from launcher.

To perform the long mode test with the Aero X5A test set, proceed as follows:

a. Perform steps a. through k. of the short mode test procedure.

b. Position ARM MASTER switch to "ON," position the MODE SELECT switch to "ROCKETS & MISSILES" and position the station selector switch to the station being tested.

c. Momentarily depress ground firing control switch on test switch panel.

d. Hold bomb-rocket release button depressed.

Note

Before holding bomb-rocket release button depressed, make certain that a minimum of 15 seconds has elapsed since completion of short mode step e.

CAUTION

Bomb button must not be held depressed for more than 30 seconds as permanent damage may result to the stepping solenoid of the station selector switch.

e. When bomb-rocket release button is depressed, lights 9, 10 and GO should go out and the NO light should illuminate.

f. Pull ground safety pin out of launcher. Lights 11 and NO should go out and the GO light should illuminate.

g. Release bomb-rocket release button. The test set should cycle and stop with lights 1 through 8 out and lights 9, 10, 11 and GO illuminated.

h. Perform a stray voltage test, using a rocket launcher firing circuit tester as outlined in short mode steps h. through j.

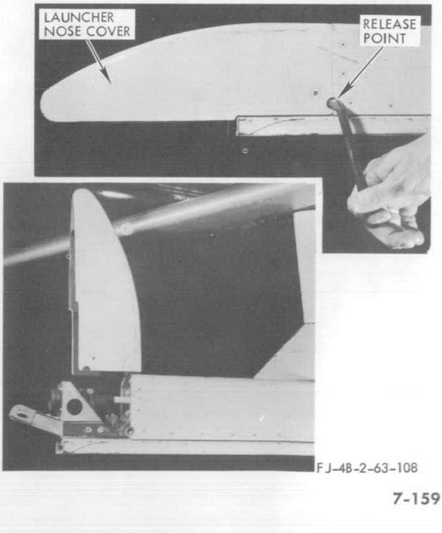
i. Make certain ground safety pin is replaced in launcher. Remove ground electrical power from the airplane's electrical system. Position armament switches to "OFF" and position STATION SELECTOR switch to station "1."

j. Remove Aero X5A test set and rocket launcher firing circuit tester from launcher.

7-191. LOADING SIDEWINDER.

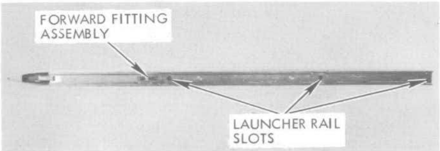
1 Install Aero 3A pylon and launcher. (Refer to paragraph 7-153.)

2 Unlock launcher nose cover using 3/8-inch Allen wrench and open by swinging upward.

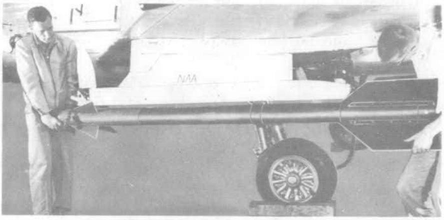


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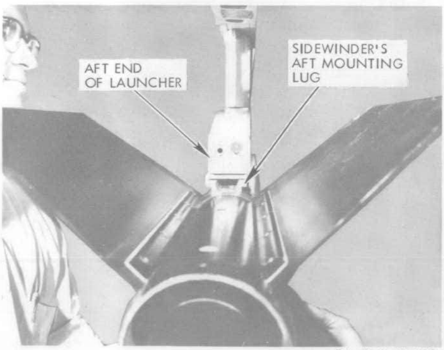
3 Raise Sidewinder to launcher and engage Sidewinder mounting lugs in launcher rail slots.





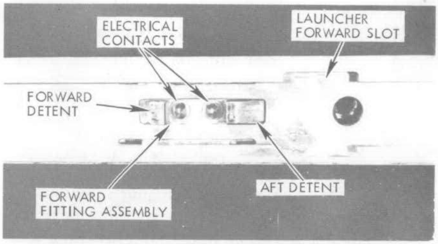


Note Sidewinder's aft mounting lug must slide in at aft end of the launcher.

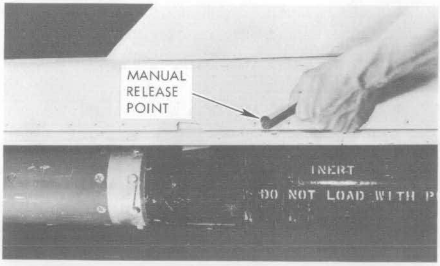


FJ-4B-2-63-109

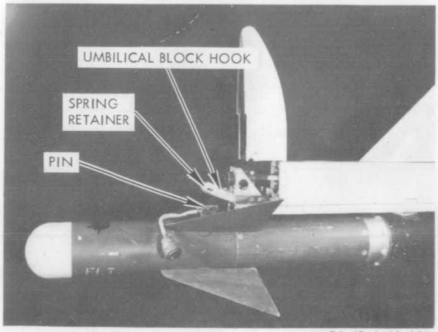
4 Slide Sidewinder forward on launcher until Sidewinder's forward mounting lug overrides the aft detent of the forward fitting assembly and locks in place.



Note Should it become necessary to unload Sidewinder, the aft detent of the forward fitting assembly can be raised manually by inserting a 3/8-inch Allen wrench at the manual release point and turning counterclockwise. Slide Sidewinder aft approximately 2-1/2 inches until Sidewinder's mounting lugs line up with launcher slots and lower away.



5 Connect launcher umbilical block hook to Sidewinder umbilical block by pressing down on hook until spring retainers snap over pins on Sidewinder umbilical block.



FJ-4B-2-63-107

For missile information, refer to the Supplemental Handbook of Maintenance Instructions (NAVAER 01-60JKE-502A).

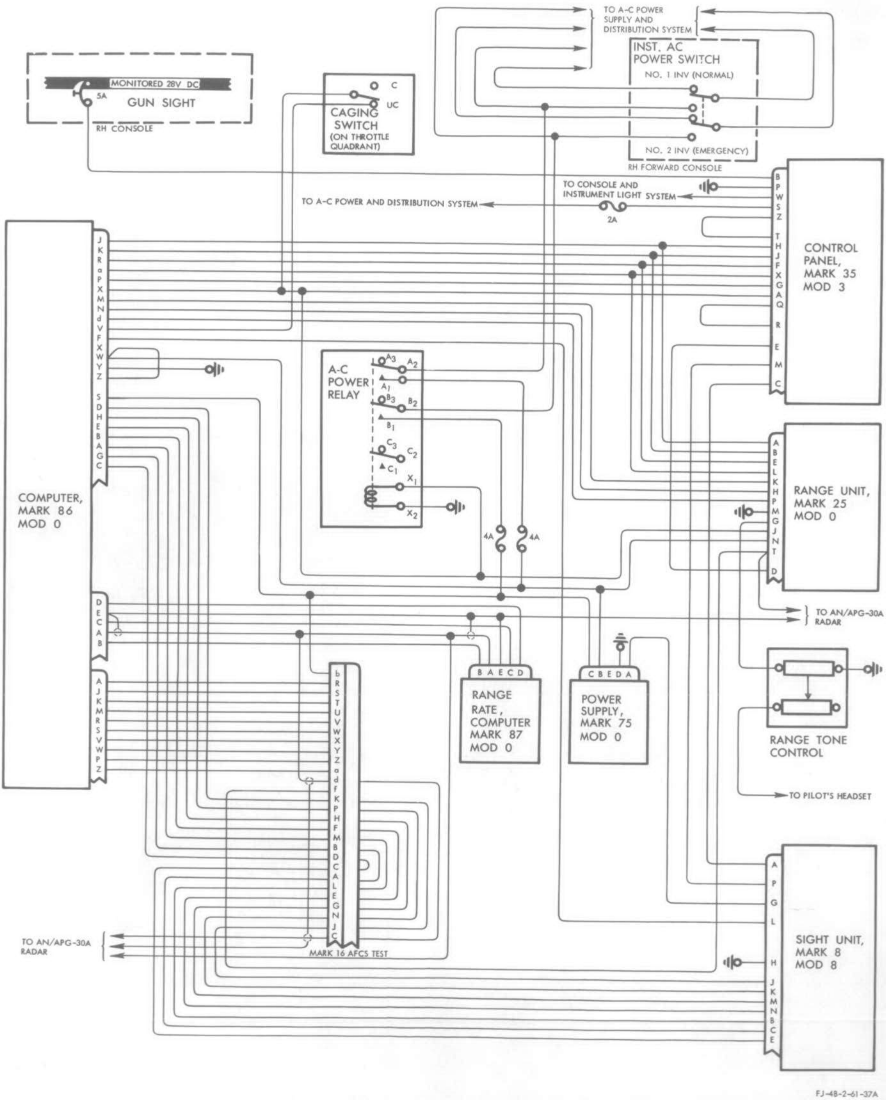


Figure No. 7-40. Aircraft Fire Control System

ARMAMENT CONTROL SYSTEM

7-192. ARMAMENT CONTROL SYSTEM.

7-193. The armament control system consists of the radar set, AN/APG-30A (paragraph 9-68), used in conjunction with the aircraft fire control system.

7-194. FUNCTION OF ARMAMENT CONTROL SYSTEM.

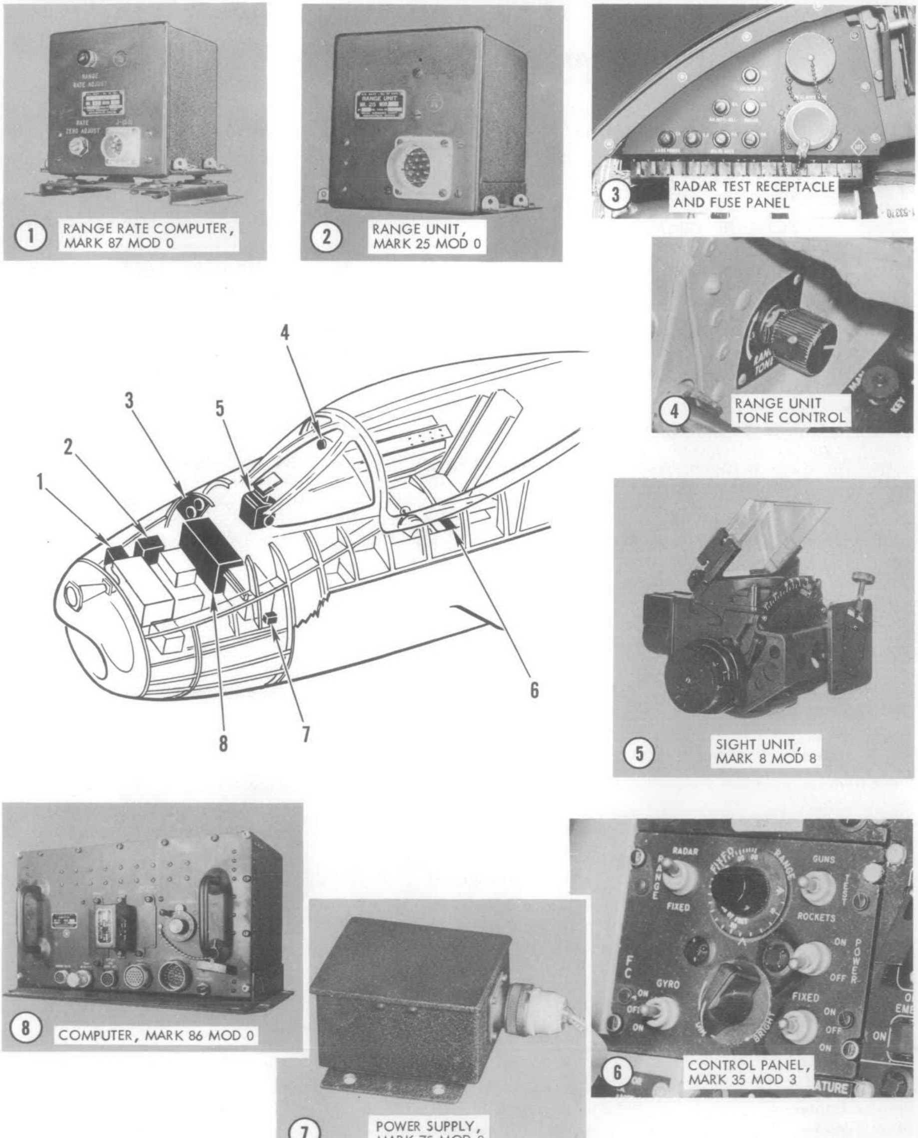
7-195. The radar set, AN/APG-30A, detects and locks onto the target and supplies the computer, Mark 87 Mod 0, and computer, Mark 87 Mod 0, with range information. The Mark 87 Mod 0 computer determines the range (closing) rate. As the target is smoothly tracked, the computer, Mark 86 Mod 0, receives the range rate information as well as other data such as atmospheric pressure, ammunition ballistics and speed of the airplane; then, the computer transmits to the sight unit the required lead to ensure consistent hits on the target. The system is designed to establish lead angles for both air-to-air and air-to-ground gunnery.

7-196. AIRCRAFT FIRE CONTROL SYSTEM.

7-197. The aircraft fire control system (figures 7-40 and 7-41) is an automatic lead-computing, pilot-operated system designed to calculate the point of aim of the guns and to provide the pilot with a simplified means of using the computations to maneuver the airplane into the proper firing position. The system features the use of potted components built up around magnetic amplifiers and transformers. The potted units are free from the vibration, filament or emission failures typical of the electronic type of computer. Plug-in units are used throughout the system, where possible, to permit the rapid replacement of circuit elements. Range information from the radar set, AN/APG-30A, ballistic data from preset controls and information from integral units are sorted and combined by the computer, Mark 86 Mod 0. The computer also applies various mathematical formulas to the data and then transmits the information to the sight unit. The sight unit presents the answers to the pilot by means of a variable line-of-sight reticle which furnishes a reference point for aiming. A package installation consisting of an angle-of-sideslip airstream direction detector and an angle-of-attack and angle-of-sideslip compensator is used for rocket firing only. The aircraft fire control system is comprised of the following components:

EQUIPMENT	WEIGHT (LB)	LOCATION	FUNCTION
Computer, Mark 86 Mod 0	60.0	Nose equipment compartment.	Lead computing.
Computer, Mark 87 Mod 0	2.5	Nose equipment compartment.	Computes range (closing) rate.
Sight Unit, Mark 8 Mod 8	8.25	Above and forward of instrument panel.	Provides visual reference point for aiming.
Power Supply, Mark 75 Mod 0	1.0	Nose equipment compartment.	Supplies d-c power to the gyro motor.
Control Panel, Mark 35 Mod 3	2.2	Left-hand console.	
Range Unit, Mark 25 Mod 0	3.4	Nose equipment compartment.	
Airflow Compensator, Mark 1 Mod 2	0.75	Attached to computer, Mark 86 Mod 0.	Compensator.
Ballistic Element, *Mark 4 Mod 1	0.4	Attached to computer, Mark 86 Mod 0.	For 5-inch HVA.
Ballistic Element, *Mark 3 Mod 2	0.75	Attached to computer, Mark 86 Mod 0.	For 2.75-inch Mighty Mouse.
Ballistic Element, Mark 2 Mod 1	0.75	Attached to computer, Mark 86 Mod 0.	Guns.

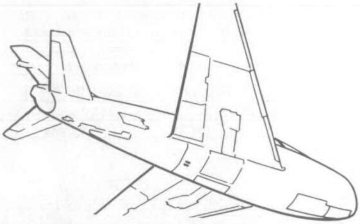
*Only one of these units can be installed at any one time



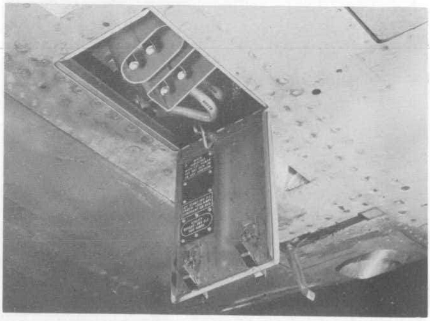
FJ-4B-2-61-38A

Figure No. 7-41. Location of Aircraft Fire Control System

7-198. OPERATIONAL CHECK OF AIRCRAFT FIRE CONTROL SYSTEM.

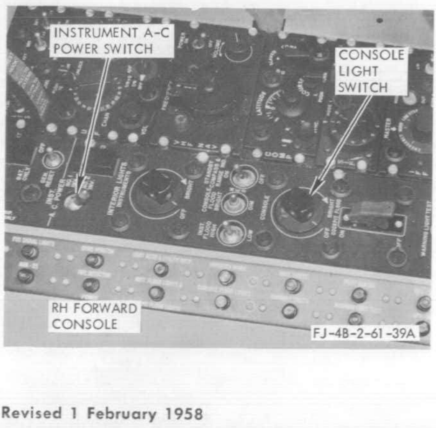


1 Connect external power source to airplane.



2 Turn CONSOLE rheostat on.

3 Place INST. AC POWER switch to "NO. 1 INV" position. Check to assure that NO. 2 INVERTER POWER circuit breaker, located on left-hand radio bay circuit-breaker panel, is in reset position. Check with voltmeter at the three secondary bus fuses and two primary bus fuses on left-hand radio bay circuit-breaker panel to be sure the voltage is between 110 and 120 volts ac.



FJ-4B-2-61-39A

Warning Before proceeding with this check, make certain that no armament is aboard and that all armament switches are turned off.

4 Make the following settings on the Mark 35 Mod 3 control panel:

GUNS-TEST-ROCKET switch to "GUNS."
FIXED switch to "OFF."
GYRO switch to "OFF."
BRIGHT - DIM dial fully counterclockwise.
FIXED RANGE dial to 2000 feet.
RADAR-RANGE-FIXED switch to "FIXED."



5 Turn POWER switch "ON." The gyro motor should start. Allow five minutes warm-up time.

6 Check that the two dial lamps on the control panel are illuminated.

7 Set the FIXED switch to the "ON" position.

8 Rotate the BRIGHT - DIM knob throughout its limits and observe the reticle images. Note that this knob varies the intensity of the image uniformly over the entire range and that the light is evenly distributed.

9 Repeat the test in steps 7 and 8 substituting the GYRO switch for the FIXED switch.

10 Move the GYRO switch to the "OFF" position. The gyro motor should be running and the gyro image should disappear.

11 Move the FIXED and GYRO switches to their top "ON" positions. The two images should appear on the reflector plate. Both images should dim and brighten together as the BRIGHT - DIM knob is turned.

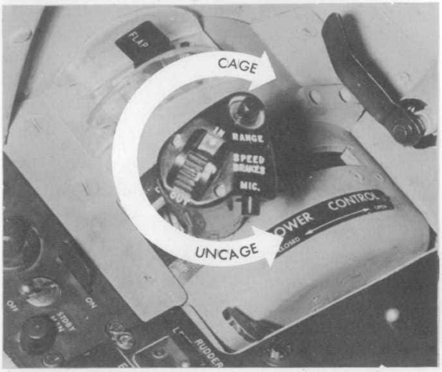
12 With the FIXED and GYRO switches set at their "ON" positions, sight on a distant object. The two reticle images should appear to coincide on the object, regardless of the reticle lamp switching combination.

13 Connect test set, AN/APM-72, to radar set, AN/APG-30A, and energize radar set. On test set, place FUNCTION SELECTOR switch in "NORM" position and MARKER SELECTOR switch in "TRACK" position. Vary TRACK RANGE control to minimum range. On control panel, Mark 35 Mod 3, place FIXED RANGE dial to 3000 feet, RADAR-RANGE-FIXED switch to "RADAR" and GUNS-TEST-ROCKETS switch to "ROCKET."

FJ-4B-2-61-40

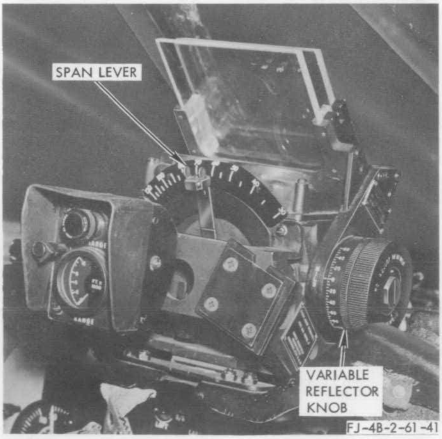
14 Decrease TRACK RANGE control slowly. Audible sound will be heard in headset at 3000 (±450) feet and will go off at 1200 (±200) feet. These tolerances are valid only as you vary track range from maximum to minimum and when the test set, AN/APM-72, and radar set, AN/APG-30A, are properly calibrated. Return GUNS-TEST-ROCKETS switch to "GUNS."

15 With the sight unit, Mark 8 Mod 8, in caged condition and 600 feet on FIXED RANGE dial on Mark 35 Mod 3 control panel, check that gyro reticle is aligned with fixed cross within 5 mils in any direction.



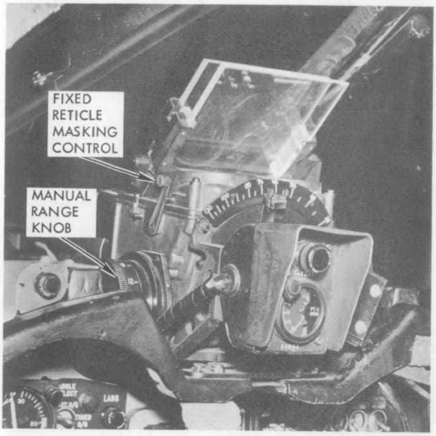
16 Place FIXED RANGE dial to "FIXED" and GUNS-TEST-ROCKETS switch to "GUNS." Operate FIXED RANGE dial from 600 to 6000 feet and check for proper deflection of gyro reticle. At 3000 feet, reticle should be down 5 (±5) mils.

17 Operate manual range knob through detented positions for 600, 900, 1200, 1500 and 2400 feet. Check for position detent in these positions and corresponding change of gyro reticle size.



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18 Move span lever from 30 to 120 feet and check that it does not override mechanical stops. Check for corresponding change in gyro reticle. Set span lever for 120 feet and manual range knob for 1200 feet. The inner tips of the gyro reticle should bound the 50 mil radius circle. The tips of the six diamonds must be visible at any combination of span lever and manual range knob setting.



19 Operate fixed reticle masking control between stops and check for complete masking and unmasking of the fixed reticle (except for the center cross).

FJ-4B-2-61-42

7-199. COMPUTER, MARK 86 MOD 0.

7-200. The computer, Mark 86 Mod 0, receives all the data supplied by the various input units, computes the data and delivers the necessary information to the sight unit to establish the correct lead angle. The face of the computer contains the ammunition ballistic unit, which varies with the type of guns and ammunition installed, the connection (static pressure) for the air pressure transmitter, which furnishes the atmospheric pressure input, a capped receptacle marked "TEST" for use with the test unit, Mark 49 Mod 1, and/or test set, Mark 282 Mod 0, and a receptacle for connection of the range rate unit. The pressure transmitter receives static pressure directly from the pitot-static pressure line by means of a "T" connector. In addition, an airplane velocity switch under the chassis must be preset for the airplane in which the computer is to be installed. The settings are 325, 450 and 600 knots ("L," "M" and "H," respectively).

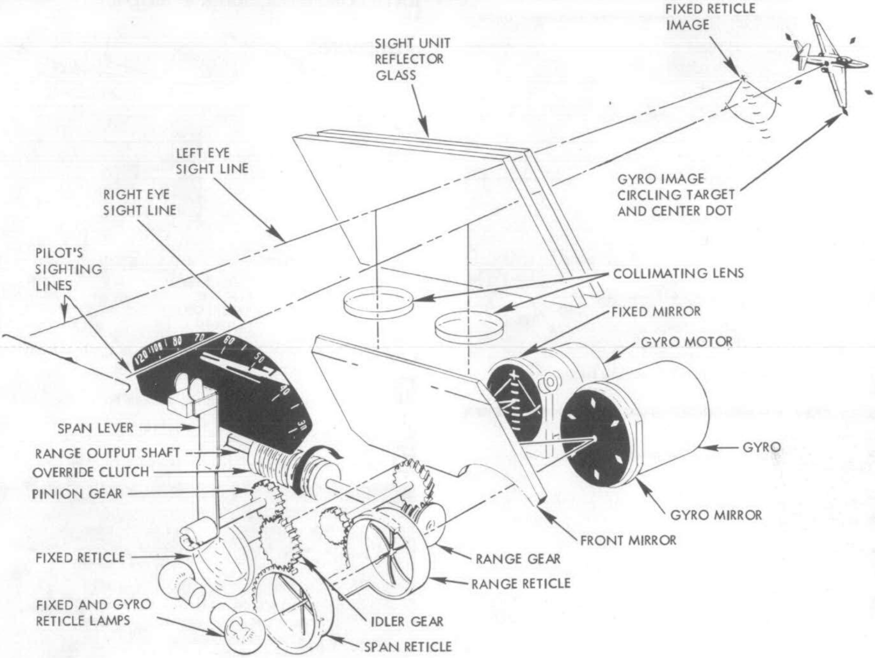
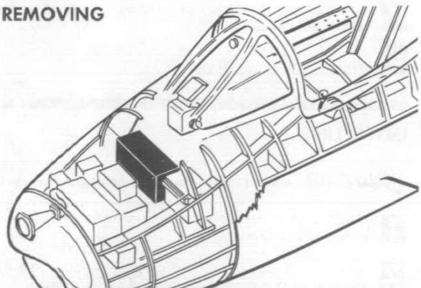


Figure No. 7-42. Sight Unit, Mark 8 Mod 8, Optical System Schematic

7-201. REMOVING AND INSTALLING COMPUTER, MARK 86 MOD 0.

REMOVING



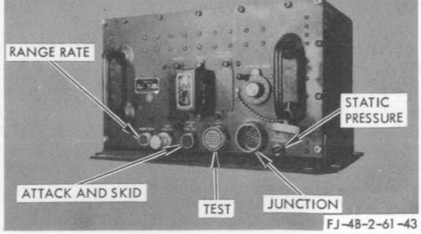
Caution Make certain no power is applied to system.

FJ-4B-2-61-43

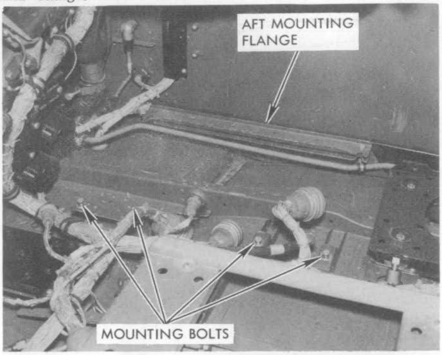
1 Remove frequency converter transmitter, RT-322/APG-30A. (Refer to paragraph 9-82.)

2 Remove range unit, Mark 25 Mod 0. (Refer to paragraph 7-214.)

3 Disconnect four electrical connectors and one pressure connection ("RANGE-RATE," "ATTACK AND SKID DET," "TEST," "JUNCTION" and "STATIC PRESSURE").



4 Remove four mounting bolts from forward lower flange.



5 Pull unit forward until aft mounting flange clears retainer.

INSTALLING

Caution Make certain no power is applied to system.

1 Position unit on mount and slide aft making certain that aft lower flange mates with securing flange.

2 Install four mounting bolts in forward flange.

3 Connect and safety-wire four electrical connectors and one pressure connector. Use AN995F32 safety wire.

4 Install frequencv converter transmitter, RT-322/APG-30A. (Refer to paragraph 9-82.)

5 Install range unit, Mark 25 Mod 0. (Refer to paragraph 7-23.)

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7-202. BALLISTIC ELEMENT.

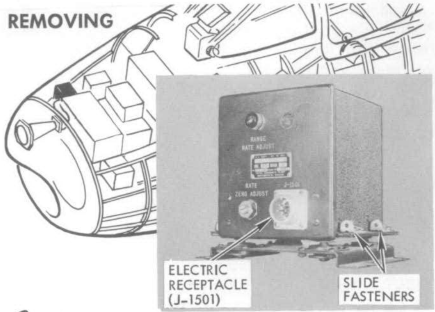
7-203. The ballistic element is a unit which plugs into the face of the computer, Mark 86 Mod 0. The unit provides necessary ballistic constants for the type of gun in use and, should the armament of the airplane be changed, the ballistic element must also be changed. Provisions are made on the face of the computer for the installation of a second ballistic element and an airflow compensator unit to provide rocket-firing constants. (Refer to paragraph 7-201.)

7-204. RANGE RATE COMPUTER, MARK 87 MOD 0.

7-205. The range rate computer, Mark 87 Mod 0, translates range voltage, as received from the radar set, AN/APG-30A, to range-rate voltages and delivers this information to the computer, Mark 86 Mod 0. The zero rate adjustment on the front of the case is set when the unit is tested with the test unit, Mark 49 Mod 1 and/or test set, Mark 282 Mod 0. Appropriate test instructions are furnished with the test unit.

7-206. REMOVING AND INSTALLING RANGE RATE COMPUTER, MARK 87 MOD 0.

REMOVING

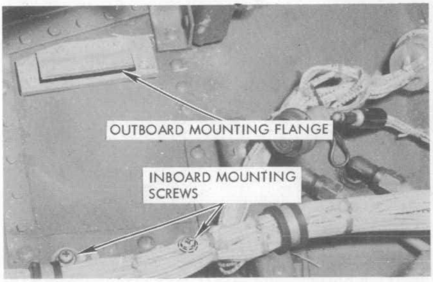


Caution Make certain no power is applied to system.

1 Remove radar compartment access door.

2 Disconnect electrical cable (J-1501).

3 Remove two screws from inboard side of mount.



4 Pull unit and mount inboard and up. Remove unit with mount attached.

5 Remove unit from mount.

INSTALLING

Caution Make certain no power is applied to system.

1 Install unit on mount and safety-wire slide fasteners with AN995F32 wire.

2 Slide mount under outboard mounting flange retainer and install two screws in inboard mount flange.

3 Connect and safety-wire cable (J-1501) with AN995F32 wire.

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7-207. POWER SUPPLY, MARK 75 MOD 0.

7-208. The power supply, Mark 75 Mod 0, furnishes d-c power for the gyro motor in the sight unit. It converts a-c power from the No. 2 inverter to the required d-c voltage. Procedures for testing the unit accompany the test unit, Mark 49 Mod 1 and/or test set, Mark 82 Mod 0.

7-209. REMOVING POWER SUPPLY, MARK 75 MOD 0. To remove power supply, Mark 75 Mod 0, proceed as follows:

a. Remove electrical power from system.

b. Remove nose equipment compartment access door.

c. Remove range unit, Mark 25 Mod 0. (Refer to paragraph 7-214.)

d. Disconnect electrical connector from face of unit.

e. Remove four mounting screws.

7-210. INSTALLING POWER SUPPLY, MARK 75 MOD 0. To install power supply, Mark 75 Mod 0, proceed as follows:

a. Remove electrical power from system.

b. Remove nose equipment compartment access door.

c. Place unit on mounting and install four screws.

d. Connect and safety-wire connector with AN995F32 safety wire.

e. Install range unit, Mark 25 Mod 0. (Refer paragraph 7-214.)

7-211. RANGE UNIT, MARK 25 MOD 0.

7-212. The range unit, Mark 25 Mod 0, operates in conjunction with the radar system in the air-to-air mode. The purpose of the range unit is to make the pipper more controllable in getting on the target at long range, to alert the pilot when the target is within the preset firing range of the type of armament carried and to indicate to the pilot the breakaway point. During a typical tracking run, the fire control system is set for radar ranging. However, at long ranges the range unit places the system in the fixed-ranging condition. This enables the system to compute according to the range value set on the dial of the control panel, Mark 35 Mod 3, resulting in a more constrained pipper than would be normal while tracking a target at long range. When the target range equals the value set on the FIXED RANGE dial on the control panel, the fire control system is automatically switched out of the fixed-range condition and radar ranging begins. At the same instant, an 800-cycle ranging tone is applied to the pilot's headset and the range indicator shows actual range in feet. The tone indicates that the target is within the preselected firing range. Intensity of the ranging tone can be varied by operation of the RANGE TONE control which is located forward of the right-hand console, adjacent to the arresting hook handle. When the target range diminishes to a minimum safe range, the ranging tone ceases, warning the pilot that he should begin his breakaway. At the same instant, the fire control system is again automatically switched to the fixed-range condition. For procedures on removing and installing the range indicator, refer to paragraph 7-215.

7-213. CHECKING RANGE UNIT, MARK 25 MOD 0.

a. Turn on radar set, AN/APG-30A, and allow time to warm up.

b. Connect test set, AN/APM-72, to radar set.

c. Place FUNCTION SELECTOR switch on test set in "NORM" position and place MARKER SELECTOR switch in "TRACK."

d. Turn TRACK RANGE control to maximum range.

e. On control panel, Mark 35 Mod 3, set FIXED RANGE dial to 3000 feet, RANGE RADAR FIXED switch to "RADAR" and GUNS-TEST-ROCKETS switch to "ROCKETS."

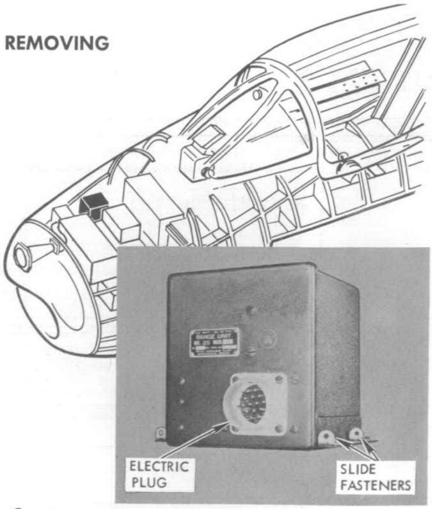
f. Decrease TRACK RANGE slowly. An audible sound will be heard in the headset at about 3000 feet and will go off at a minimum safe range.

Note

These tolerances are valid only as the TRACK RANGE is varied from maximum to minimum and when the radar set, AN/APG-30A, and the test set, AN/APM-72, are calibrated.

7-214. REMOVING AND INSTALLING RANGE UNIT, MARK 25 MOD 0.

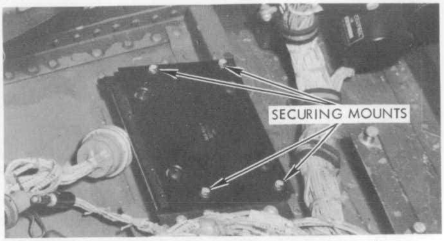
REMOVING



Caution Make certain no power is applied to system.

1 Disconnect electrical plug on face of unit.

FJ-4B-2-61-47



Note It is imperative that the following steps be performed in sequence.

2 Cut safety wire on the two inboard and the forward outboard slide fasteners. Release fasteners.

3 Using the rear outboard fastener as a pivot point, lift unit and swing approximately 45 degrees counterclockwise.

4 Cut safety wire and release rear outboard slide fastener.

INSTALLING

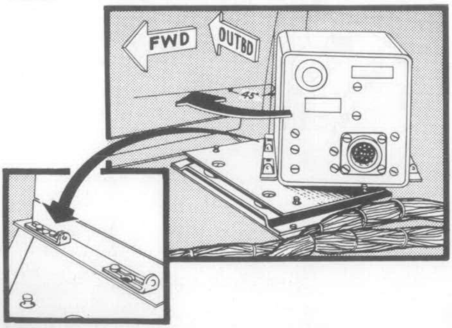
Caution Make certain no power is applied to system.

1 Place rear outboard corner of unit on mount with other three securing points approximately 45 degrees counterclockwise.

2 Secure and safety-wire rear outboard fastener with AN995F32 wire.

3 Install AN995F32 safety wire in forward outboard mount point.

4 Inserting installed safety wire through forward outboard mounting hole in unit, position unit flush on mount.



5 Close and safety-wire remaining fasteners with AN995F32 wire.

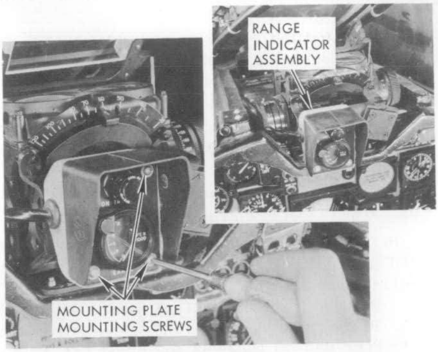
6 Connect and safety-wire electrical plug with AN995F32 wire.

FJ-4B-2-61-48

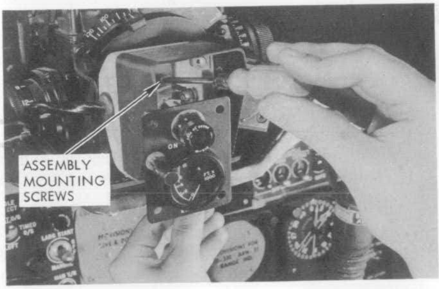
7-215. REMOVING AND INSTALLING RANGE INDICATOR.

REMOVING

1 Remove four mounting screws on front of range indicator assembly.



2 Pull range indicator mounting plate forward.



Note If necessary, remove entire range indicator assembly. Remove two mounting screws using a 3/8-inch open end wrench and screwdriver.

INSTALLING

1 Carefully bend wires and push range indicator mounting plate into position in line with the four mounting holes.

2 Install four mounting screws and washers.

FJ-4B-2-61-49

7-216. AIRCRAFT FIRE CONTROL SYSTEM CONTROLS.

7-217. All controls for the aircraft fire control system are located on the sight unit, Mark 8 Mod 8 (paragraph 7-222), and the control panel, Mark 35 Mod 3 (paragraph 7-198). The controls on the sight unit consist of a span lever, a range knob, a variable reflector knob and the fixed reticle masking control. On the control panel, the RANGE RADAR FIXED switch selects either radar (automatic) range or fixed (estimated) range; the FIXED RANGE control sets in the threshold for firing tone or is used for emergency ranging in event of radar failure; the GUNS-TEST-ROCKETS switch adapts the system for type of armament and provides for flight checks; the POWER-ON-OFF switch is the master power switch; the FIXED-ON-OFF-ON switch illuminates the fixed reticle; the DIM-BRIGHT control varies the light intensity of the sight images; and the GYRO-ON-OFF-ON switch energizes the gyro motor and computer and illuminates the gyro image.

7-218. SIGHT UNIT, MARK 8 MOD 8.

7-219. The sight unit, Mark 8 Mod 8, is a gyro-stabilized, lead-computing reflector type of sight which provides the pilot with an offset sight line, having the proper lead angle for aiming fixed, forward firing armament in fighter-type airplanes. The unit incorporates both a fixed and a movable reticle projection system. Each reticle image is projected through a separate collimating lens to the reflecting glass. This reticle image projection through the separate collimating lens makes the two images appear to be superimposed only when viewed with both eyes. The fixed reticle image can be divided into two separate patterns (figure 7-42). The full reticle pattern has a vertical ladder scale, graduated in 10-mil increments, a 50-mil circle, a 4-mil center cross and two straight lines diverging toward the bottom, each 45 degrees from the vertical. Masking the fixed reticle image eliminates all but the center cross. The gyro reticle image is an imaginary circle formed by the inside tips of six diamonds with an inside diameter of 40 mils and a pipper with a 1.5-mil diameter.

Note

With zero lead prediction, the centers of the gyro and fixed reticle images should coincide.

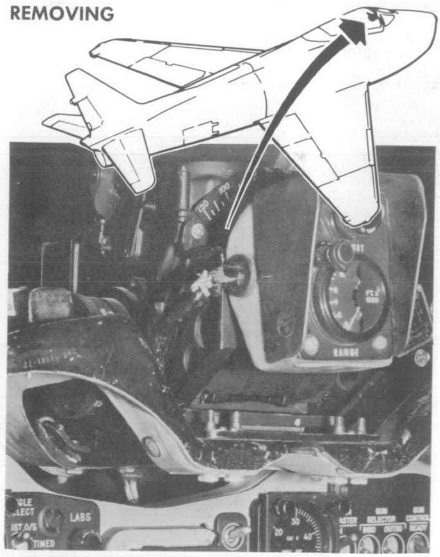
The gyro reticle projection system (figure 7-42) transmits the information furnished by the other units into lead prediction information for the pilot's use. The gyro reticle image originates from a frosted lamp, the rays of which are directed through a span reticle and a range reticle to the gyro mirror. The gyro mirror reflects the light rays onto the front mirror and then through a collimating lens which directs the rays to the sight head reflector glass. The fixed reticle image originates from another frosted lamp. The rays of this lamp are directed through the fixed reticle to the fixed mirror. The fixed mirror reflects the rays onto the front mirror then through a separate collimating lens to the reflector glass. The reflector glass consists of two 1/4-inch plates spaced approximately 1/2 inch apart. For cleaning instructions, refer to paragraph 7-224.

7-220. FUNCTION OF SIGHT UNIT, MARK 8 MOD 8.

7-221. When the sight unit is operated, the gyro range coils produce a unidirectional magnetic field concentrated in the gyro pole gaps between the inner and outer poles. As the dome spins in the magnetic field, eddy currents are induced in the dome. These eddy currents produce drag forces on the dome and tend to precess the dome toward the effective center of the magnetic field. As a result, the entire gyro assembly aligns itself so the spin axis passes through the center of the magnetic field. When the airplane is flown in a straight and level path, the gyro spin axis passes through the center of the magnetic field. When the airplane is turned during tracking the target, the gyro spin axis tries to maintain its original position, but lags behind the magnetic field. This lag of the gyro axis causes the gyro mirror to tilt. The tilting of the mirror causes the gyro reticle to lag the image produced by the fixed reticle. The deflection of the gyro image indicates the lead angle. The amount of lag depends on the airplane's rate of turn and the strength of the magnetic field. The field strength is determined by the amount of current in the range coils. The amount of current to the range coils is determined by the computer, Mark 86 Mod 0.

7-222. REMOVING AND INSTALLING SIGHT UNIT, MARK 8 MOD 8.

REMOVING

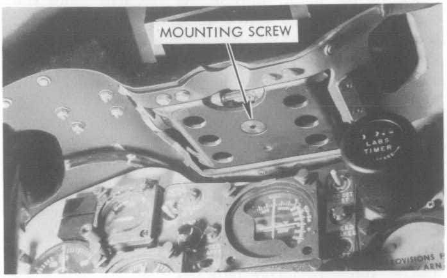


1 Remove range meter (paragraph 7-215) and camera (paragraph 7-130).

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2 Rotate seven stud fasteners on front of instrument panel counterclockwise. Allow instrument panel to come aft to position where cords are taut.

3 Disconnect sight unit electrical connector.



4 Remove mounting screw.

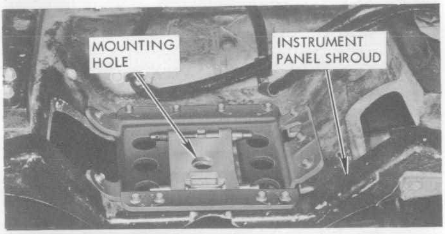
Note This is a special screw and must be retained for reinstallation.

5 Remove sight unit from airplane.

INSTALLING

1 Place sight unit on instrument panel shroud.

2 Install mounting screw.



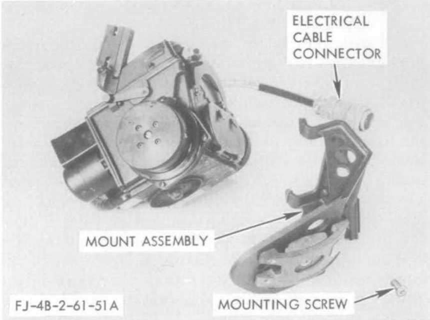
3 Connect electrical cable and safety to safety tab with AN995F32 wire.

4 Install instrument panel. (Refer to paragraph 6-21.)

5 Install camera. (Refer to paragraph 7-130.)

6 Bore-sight sight unit. (Refer to paragraph 7-229.)

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FJ-4B-2-61-51A

7-223. REPLACING SIGHT UNIT LAMPS. To replace sight unit lamps, proceed as follows:

a. Depress the two latches behind the sight unit mount.

b. Open lamp cover.

c. Lamps are secured to the lamp cover and can be removed with the fingertips.

Note

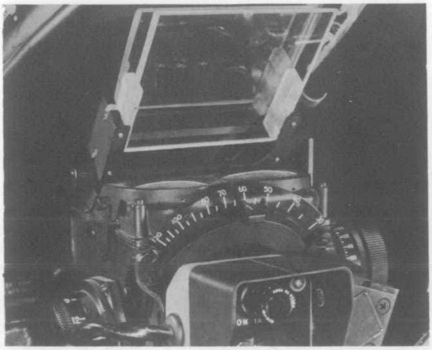
Replace all lamps which show signs of blackening.

d. Insert a new lamp so that the frosted spot on the lamp faces toward the reticle when the lamp cover is closed.

e. Close lamp cover, being careful to fasten latches securely.

7-224. CLEANING SIGHT UNIT REFLECTOR GLASS AND COLLIMATING LENSES.

1 To remove dust from the sight unit reflector glass and collimating lenses, use a fine camel's hair brush or wipe lightly with lens tissue.



FJ-4B-2-61-52

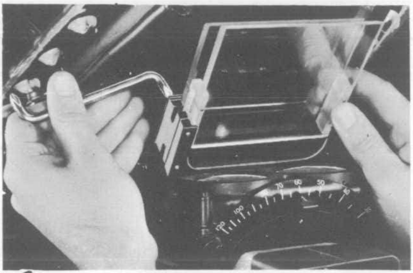
2 Dirt streaks or smudges on the surfaces may be removed by wiping with a moist, lint-free, soft cloth.

Caution Do not rub hard or use harsh cleaners on lenses. The highly polished surfaces can be easily scratched or marred.

3 Dirt streaks and smudges on the inner surfaces of the reflector glass are extremely hard to remove and will require removal of the reflector glass.

4 Dirt streaks or smudges which persist may be wiped with a moist cloth and mild white soap.

5 Use a 90-degree offset Phillips head screwdriver to loosen the four mounting screws.



Caution During removal, hold reflector glass firmly with free hand to protect against breakage.

6 After removal, the reflector glass may be immersed in a white soap and water solution. FJ-4B-2-61-96

7-224A. TROUBLE SHOOTING MARK 16 MOD 1 AIRCRAFT FIRE CONTROL SYSTEM POWER SUPPLY.

TEST EQUIPMENT: A-C—D-C voltmeter.
Ohmmeter.

SYSTEM CONDITIONS: External power applied to airplane.
GUNSIGHT circuit breaker engaged.
INST. AC POWER switch placed in "NO. 1 INV." position.
POWER switch and GYRO switch on Mark 35 Mod 3 control panel placed in "ON" positions.
NO. 2 INVERTER POWER circuit breaker engaged.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
NO POWER TO MARK 16 MOD 1 AIRCRAFT FIRE CONTROL SYSTEM.			
Defective fuse or power input to fuse.	Check test points ADA and ADB to ground.	115 volts ac.	Replace defective fuse.
		Other than 115 volts ac.	Continue trouble shooting.
	Check test points ADL and ADM to ground.	115 volts ac.	Replace defective wiring between test points ADL and ADA or ADM and ADB as required.
		Other than 115 volts ac.	Continue trouble shooting.
	Check test points ADJ and ADH to ground.	115 volts ac.	Refer to probable cause, "Defective AC POWER Relay or Control Circuit to Relay."
		Other than 115 volts ac.	Replace defective wire segments between test point ADJ or ADH and INST. AC POWER switch as required or refer to paragraph 8-78, Trouble Shooting A-C Power Supply and Distribution System.

PROBABLE CAUSE	ISOLATION PROCEDURE	METER READING	REMEDY
NO POWER TO MARK 16 MOD 1 AIRCRAFT FIRE CONTROL SYSTEM. (Cont)			
Defective AC POWER relay or control circuit to relay.	Check test points ADK, ADL and ADM to ground.	28 volts dc at test point ADK. Other than 115 volts ac at test points ADL and/or ADM.	Replace defective relay.
		Other than 28 volts dc at test point ADK.	Continue trouble shooting.
	Check test point ADN to ground.	28 volts dc.	Replace defective wire segment between test points ADK and ADN.
		Other than 28 volts dc.	Continue trouble shooting.
	Check test point ADP to ground.	28 volts dc.	Replace Mark 35 Mod 3 control panel or defective wire segment to test point ADN.
		Other than 28 volts dc.	Continue trouble shooting.
	Check test point ADQ to ground.	28 volts dc.	Replace defective circuit breaker or defective wire.
		Other than 28 volts dc.	Refer to paragraph 8-61, Trouble Shooting D-C Power Distribution System.
Defective wire between fuses and components of Mark 16 Mod 1 aircraft fire control system.	Check test points ADC, ADD, ADE, ADF and ADG to ground.	115 volts ac.	Refer to Handbook of Service Instructions (NAVAER 11-70HB-502) for trouble within components of Mark 16 Mod 1 aircraft fire control system.
		Other than 115 volts ac.	Perform wire segment check between affected test point and appropriate fuse. Repair wire as required.
MARK 8 MOD 8 SIGHT RETICLE NOT ILLUMINATED.			
Defective fuse or power input to fuse.	Check test point ADS to ground.	115 volts ac.	Replace defective fuse.
		Other than 115 volts ac.	Refer to paragraph 8-78, Trouble Shooting A-C Power Supply and Distribution System.
Defective wire segment between fuse and Mark 35 Mod 3 control panel.	Perform wire segment check between test points ADS and ADR.	Zero ohms.	Refer to Handbook of Service Instructions (NAVAER 11-70HB-502) for internal trouble in Mark 16 Mod 1 aircraft fire control system.
		Other than zero ohms.	Replace defective wire segment between test points ADS and ADR.

ARMAMENT HARMONIZATION

7-225. ARMAMENT HARMONIZATION.

7-226. Harmonization is the positioning of the guns, gun sight and gun camera in relation to each other. The airplane is positioned and held rigid and the guns are bore-sighted to a reference point. The reference point is a target board with aligning marks properly spaced for sighting to a selected pattern. The guns can be aligned to fire into space parallel to each other or to converge at a distance of 1000 feet. The gun sight and the gun camera are aligned in relationship to the guns. Two bore-sighting fixtures are used in aligning the airplane and the target board: a ring sight and a peep sight. The mounting brackets for the ring sight and peep sight are positioned, bolted and lead-sealed during assembly of the airplane. When needed, the ring sight and peep sight fixtures are inserted through access holes in the fuselage and mated with the supporting brackets.

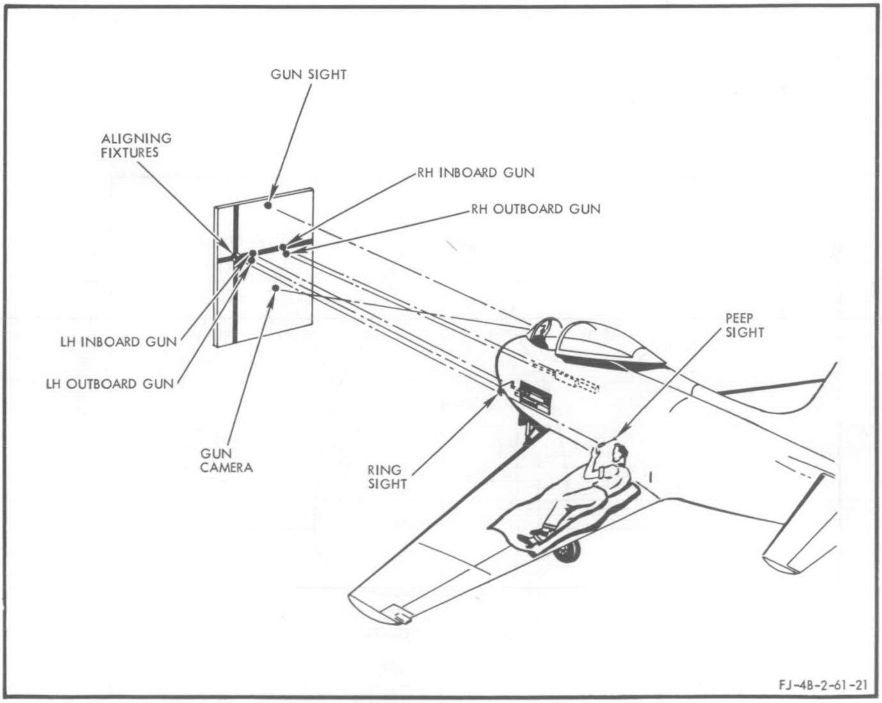
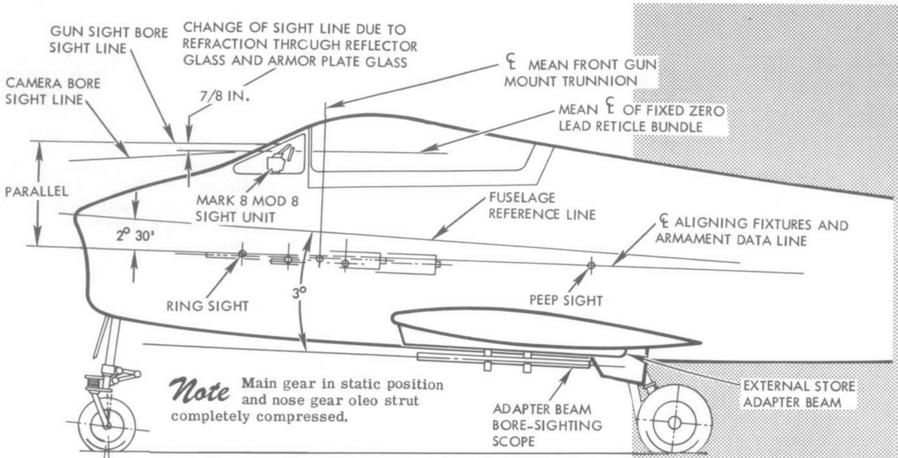


Figure No. 7-43. Harmonization Reference Points (Sheet 1)



Note Main gear in static position and nose gear oleo strut completely compressed.

Note The 3° is for the boresight tool only and does not reflect the angle of rocket packages, bombs, Aero 15B or Aero 15C or centerline of weapons. (No adjustment is available.)

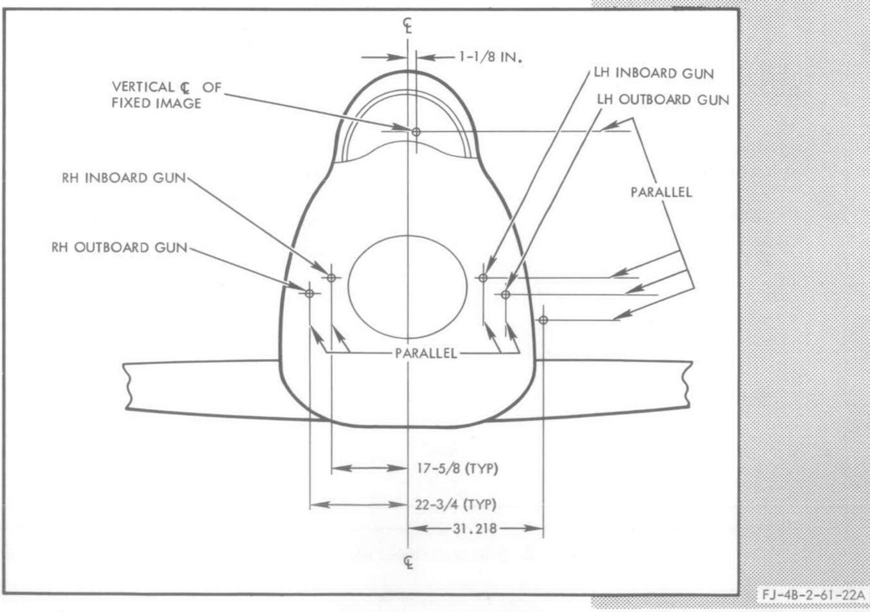


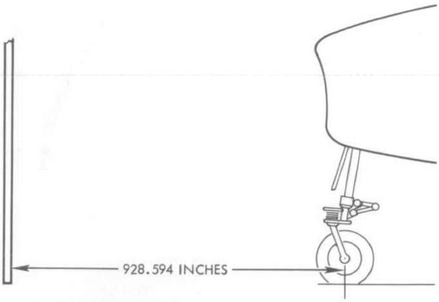
Figure No. 7-43. Harmonization Reference Points (Sheet 2)

7-227. ALIGNING TARGET BOARD AND AIRPLANE.

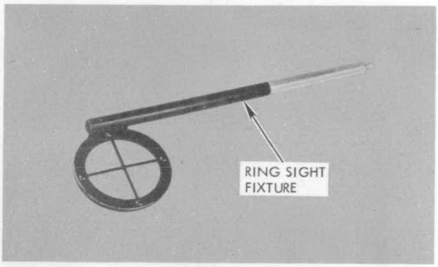
Note

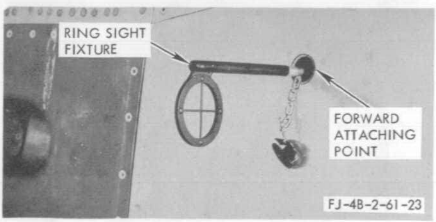
- This procedure does not require use of a true level surface. However, relative positions of the airplane and target board must remain unchanged during harmonization.
- Make certain that the proper target board is used for the desired bore-sighting pattern. Target board aligning marks are spaced differently for parallel and converging pattern bore sighting. (See figure 7-44.)

1 Position target 928.594 inches (77 feet, 4-19/32 inches) forward of vertical centerline of nose wheel.



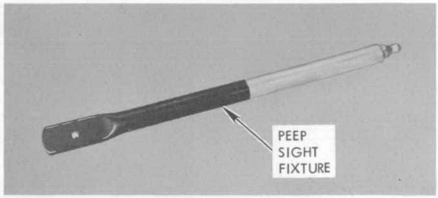
2 Install ring sight fixture (T2668) in fixture attaching point forward of left-hand gun bay.

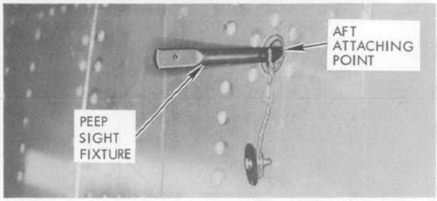




FJ-4B-2-61-23

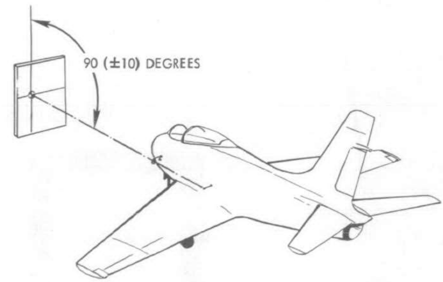
3 Install peep sight fixture (T276-20) in fixture attaching point below left-hand engine access panel.





4 Sight through peep sight and ring sight to aligning mark on target board.

Note The angle between the centerline of the aligning fixtures and the plane of the target board should be 90 (±10) degrees.



5 Position airplane to align bore-sighting fixtures with target by deflating nose gear oleo strut and, if necessary, inflating main gear struts.

6 Correct relationship is established between target board and airplane when cross of ring sight fixture appears superimposed upon target board aligning mark.

7 Re-check distance from target board to vertical centerline of nose wheel; then, re-check alignment of target board and airplane aligning fixtures.

FJ-4B-2-61-24

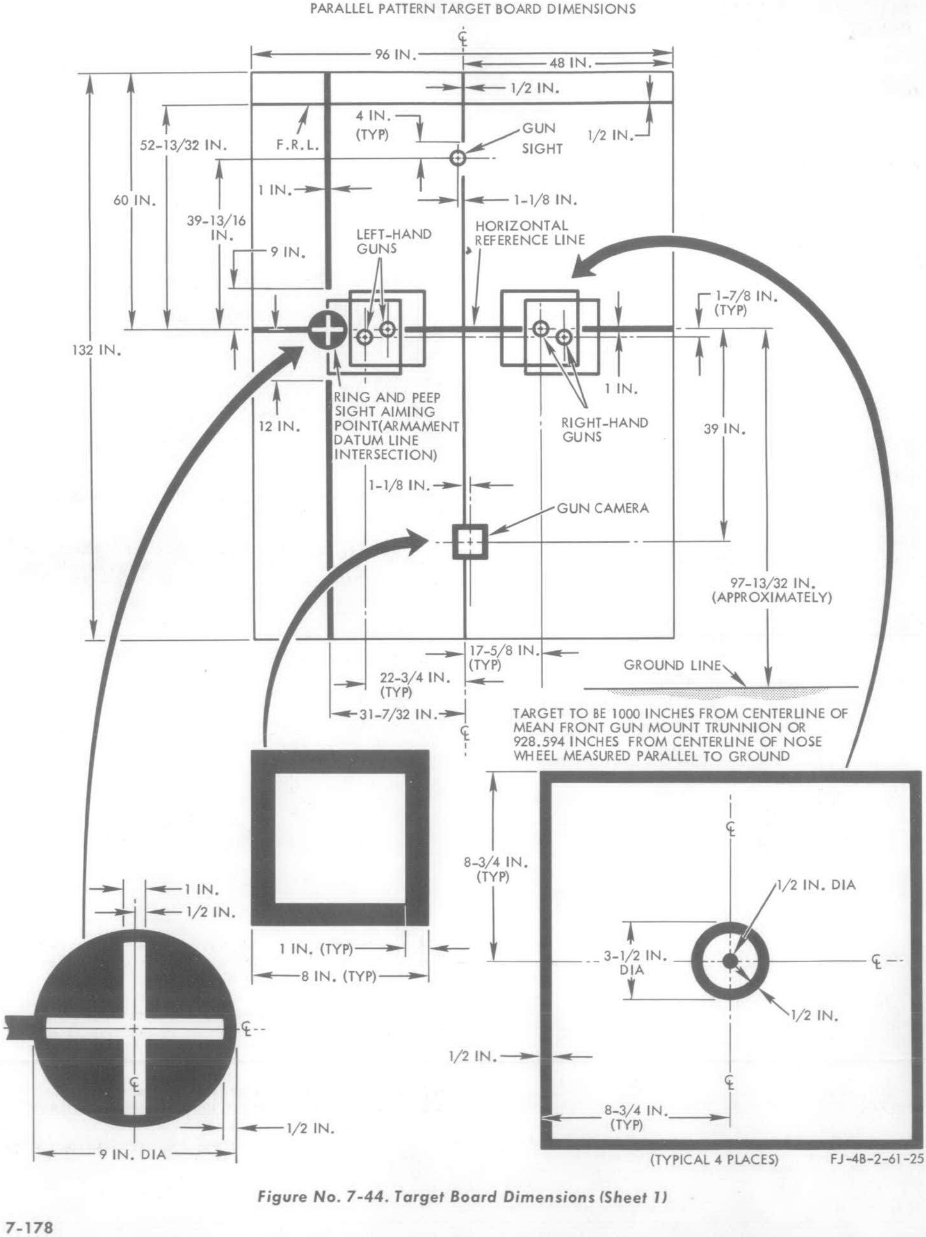
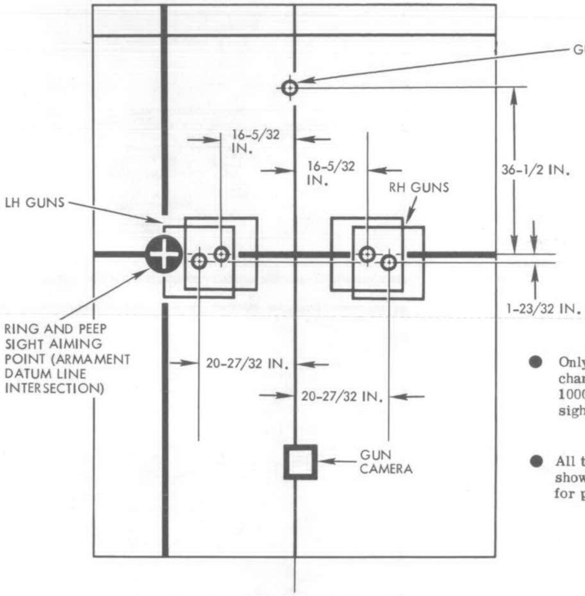


Figure No. 7-44. Target Board Dimensions (Sheet 1)

1000-FOOT CONVERGING PATTERN TARGET BOARD DIMENSIONS



TARGET TO BE 1000 INCHES FROM CENTERLINE OF MEAN FRONT GUN MOUNT TRUNNION OR 928.594 INCHES FROM CENTER-LINE OF NOSE WHEEL MEASURED PARALLEL TO GROUND.

Note

- Only those dimensions shown must be changed to adapt the target board for 1000-foot converging pattern bore sighting.
- All target board dimensions not shown remain the same as those used for parallel pattern bore sighting.

FJ-4B-2-61-26

Figure No. 7-44. Target Board Dimensions (Sheet 2)

7-228. BORE SIGHTING GUNS.

1 With the airplane and the bore-sighting target positioned and aligned, remove electrical power from the airplane electrical system. Remove the gun bay doors and proceed as follows:

Caution Check to make sure gun breechlocks are to the rear and guns are clear. Disconnect charger and buffer pneumatic lines at quick-disconnects.

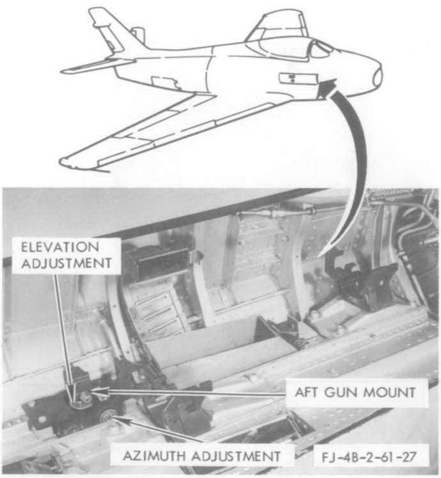
2 Loosen gun muzzle stabilizer locking bolts to allow free horizontal and vertical movement of gun muzzles. The muzzle stabilizer locking bolts may be loosened with the muzzle stabilizer tool (T2580-11). (See figure 7-9.)

3 Remove gun feeder mechanism from guns. (Refer to paragraph 7-23.)

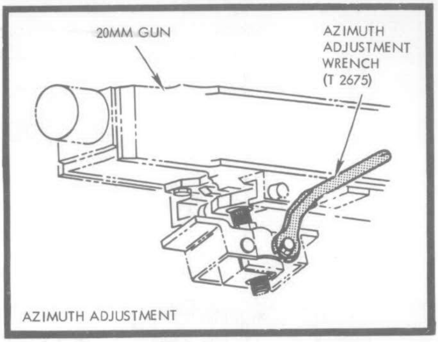
4 Remove outboard gun from airplane. (Refer to paragraph 7-22.)

5 Insert a breech-type Mark 1 Mod 0 bore-sighting tool (J942-B-2444) in inboard gun breech.

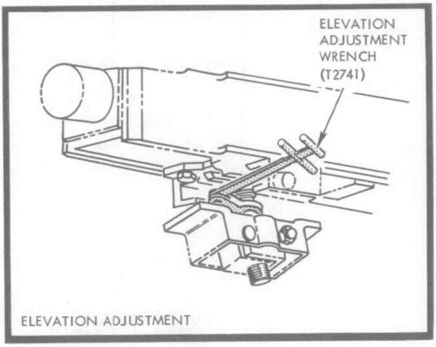
6 With conventional breech-type bore-sighting tool in place, sight to respective gun aligning mark on target board. Adjust aft gun mount to align gun with aligning mark on target board. Vertical error is adjusted by turning elevation adjustment nut on aft gun mount. Gun elevation adjustment nuts may be adjusted with a gun mount aft elevation adjustment wrench (T2741). Horizontal error is adjusted by turning azimuth adjustment nut on side of aft gun mount. Azimuth adjustment may be adjusted with an azimuth adjustment wrench (T2675).



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AZIMUTH ADJUSTMENT



ELEVATION ADJUSTMENT

7 After gun has been adjusted to align with target board aligning mark, check barrel muzzle for binding in muzzle stabilizer. Center muzzle stabilizer and tighten the muzzle stabilizer locking bolts using muzzle stabilizer adjusting tool (T2580-11).

8 Re-check alignment of gun with aligning mark on target and remove bore-sighting tool from gun breech.

9 Install outboard gun in airplane. (Refer to paragraph 7-22.)

10 Remove cover from gun bay purge exit door actuator.

11 Remove zerk fitting from purge exit door actuator arm.

12 Accomplish steps 5 through 8 to bore sight outboard gun.

13 Install gun feeder mechanisms on guns. (Refer to paragraph 7-23.)

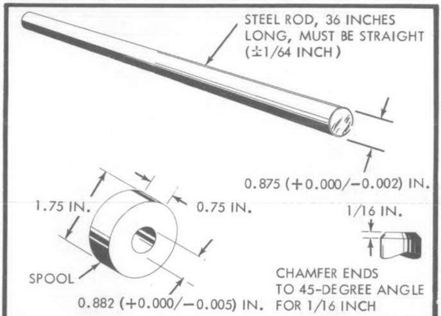
14 Reinstall gun bay purge exit door actuator cover and zerk fitting.

15 Install gun bay doors.

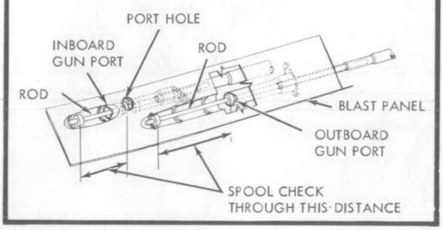
FJ-4B-2-61-28

Note Upon completion of the gun bore-sighting operation, the following checks must be made to ensure that the blast panels are properly positioned and that sufficient clearance exists between the gun ports and gun barrels to prevent projectiles from striking the gun ports.

16 Insert steel rod in gun barrel.



Note
- Rod can be manufactured from steel stock to dimensions shown.
- Spool can be manufactured from metal or hardwood to dimensions shown.



17 Place hardwood or metal spool on rod.

18 Slide spool along rod until spool reaches nearest end of blast tube or can be seen through port hole into blast tube manifold.

19 There should be no binding between the spool and gun port and the rod should not be deflected during the checking operation. The spool should not have to be forced during any part of its travel.

20 If force must be applied to move the spool through the required range of travel, the blast tube, muzzle stabilizer and blast panel installations should be checked for installation discrepancies.

21 Remove spool and rod from gun barrel.

FJ-4B-2-61-29

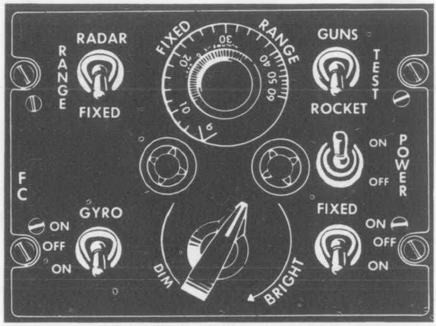
7-229. BORE SIGHTING MARK 8 MOD 8 GUN SIGHT UNIT.

1 With the airplane and bore-sighting target positioned and aligned, apply electrical power to the airplane electrical system and engage GUN SIGHT circuit breaker.

2 Position POWER switch on Mark 35 Mod 3 control panel to "ON" position.

3 Position FIXED sight reticle switch on control panel to "ON" position.

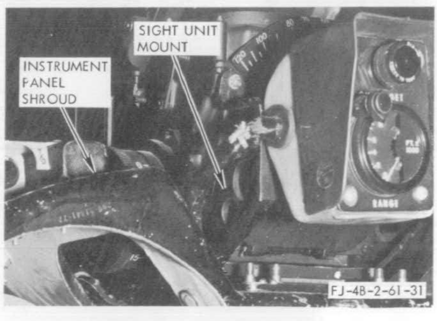
4 Adjust dim-bright sight reticle illumination knob on the control panel to the intensity desired.



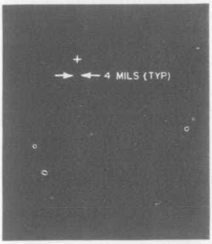
MARK 35 MOD 3 CONTROL PANEL

5 Loosen sight unit locking bolt approximately one-fourth turn. Locking bolt is accessible under instrument panel shroud at center of sight unit mount.

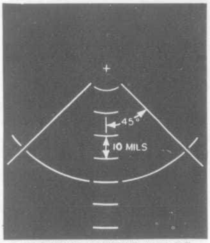
6 Note position of cross of fixed reticle image relative to aligning point on target board. If the fixed reticle image cross does not coincide with the aligning point, the sight unit alignment may be adjusted through two screws at the adjustment plate below the sight unit mount. The adjustment plate and screws are accessible through an access opening in the concave section of the instrument panel shroud just aft of the instrument panel.



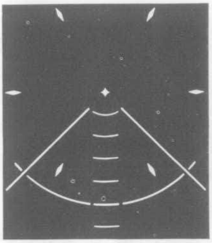
FJ-4B-2-61-31



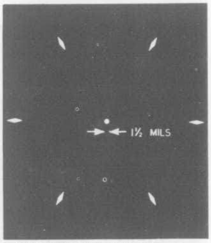
MASKED FIXED RETICLE IMAGE



FULL FIXED RETICLE IMAGE PATTERN



GYRO RETICLE IMAGE SUPER-IMPOSED ON THE FULL FIXED RETICLE IMAGE



GYRO RETICLE IMAGE PATTERN

7 Correct horizontal error by turning the forward adjusting screw, thus changing the position of the yoke assembly. Vertical error is corrected by turning the aft adjustment screw.



BORE-SIGHT ADJUSTMENT PLATE

8 Adjust the sight unit until the center of the fixed reticle cross coincides with the target board alignment mark within ± 0.85 mil.

9 Tighten sight unit locking bolt.

10 Check security of sight unit mount locking bolt and bore-sight adjustment plate: then, re-check alignment of sight reticle image with target bore-sight point.

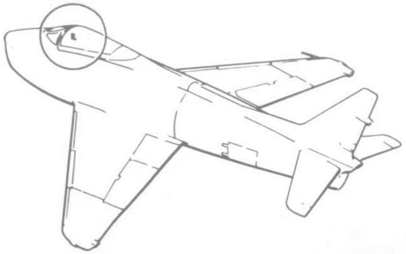
11 Position FIXED sight reticle switch and POWER switch on Mark 35 Mod 3 control panel to "OFF" position. Remove electrical power from airplane electrical system.

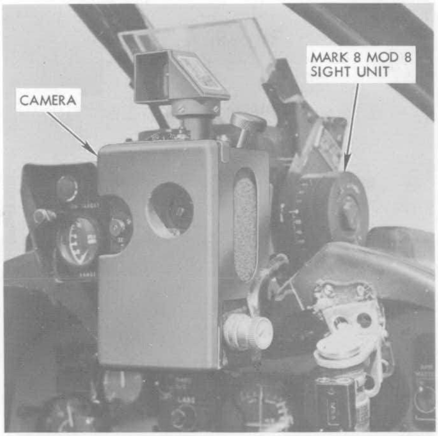
FJ-4B-2-61-32

7-230. BORE SIGHTING AN-N6A GUN CAMERA.

1 Align airplane and target board. (Refer to paragraph 7-227.)

2 Open camera film magazine access door and remove film magazine.





3 Open camera shutter. Shutter may be opened by turning shutter speed knob to a neutral position midway between two speed settings; then rotate magazine driving spline by hand until shutter opens.

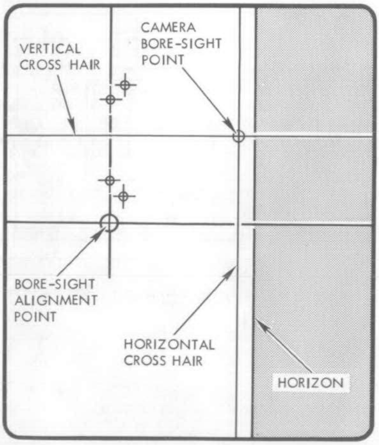
4 Set lens index ring marking of "64" to index mark on lens barrel. Set diaphragm adjustment ring index mark to "D" on index ring.

5 Insert an AN-1 camera bore-sight tool (E18B1290-255) in film magazine compartment.

FJ-4B-2-61-33



Note The AN-1 aligning indicator provides a five-power magnified view of the visible field. Objects within the indicator field of vision will appear rotated 90 degrees from normal.



6 When looking into the camera bore-sight tool, the pattern engraved on the lens should be superimposed on the appropriate camera bore-sight point on target board. The camera mount is preset in relation to the Mark 8 Mod 8 gun sight mount. Bore sighting the sight unit aligns the camera at the same time. If, after the gun sight unit is bore-sighted, the camera is not aligned with the proper target board mark, shims may be added between the dovetail fittings of the camera and sight unit mounts to correct the alignment.

7 Remove AN-1 camera bore-sight tool from film magazine compartment and reinstall film magazine.

8 Set shutter speed knob to any desired shutter speed. Do not leave shutter speed knob in a neutral position.

FJ-4B-2-61-34

7-231. BORE SIGHTING EXTERNAL STORE ADAPTER BEAMS.

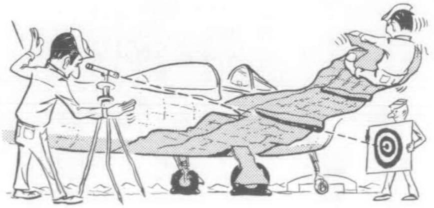
1 In the event of structural damage and/or structural repair of the airplane, the bore-sight alignment of the adapter beams should be checked to ensure correct alignment. With the airplane and the normal and rocket bore-sighting targets positioned and aligned, proceed as follows to check the bore-sight alignment of the external store adapter beams.

2 Check alignment of peep sight and ring sight bore-sighting tools with aligning mark on target. Check positioning of adapter beam bore-sighting targets.

3 Attach rocket bore-sight adapter tool to the adapter beam using bomb-rocket rack attaching adapters.

4 Attach rocket bore-sight scope to the adapter.

5 Check alignment of the bore-sight scope cross hairs with the corresponding rocket bore-sighting target. If cross hair does not fall within the 17- by 34-inch bore-sighting target, the installation is unacceptable. Alignment of the adapter beams is not adjustable.



FJ-4B-2-61-35

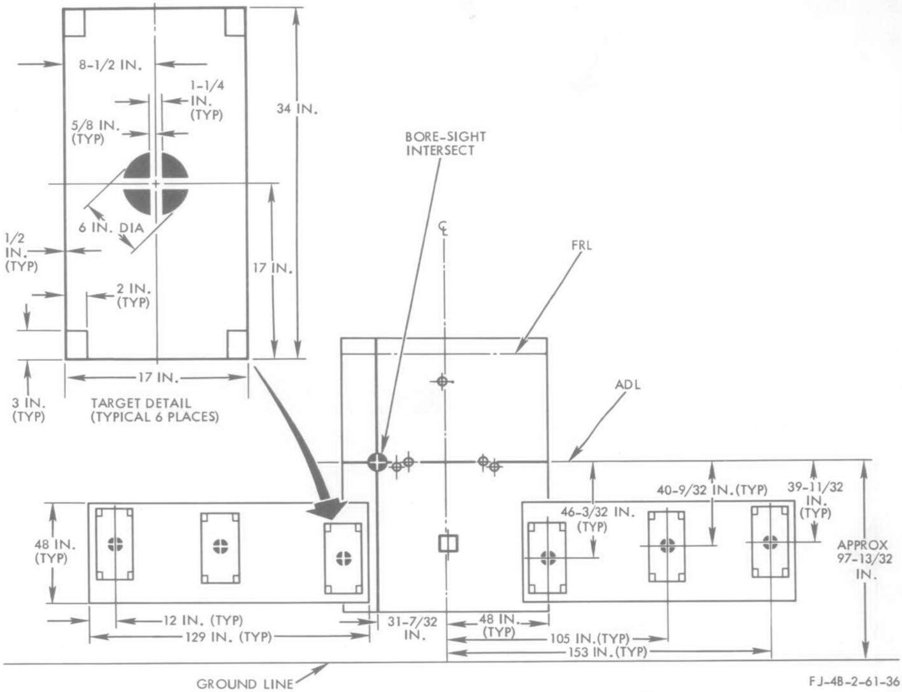


Figure No. 7-45. External Store Adapter Beam Bore-sighting Target Board Dimensions

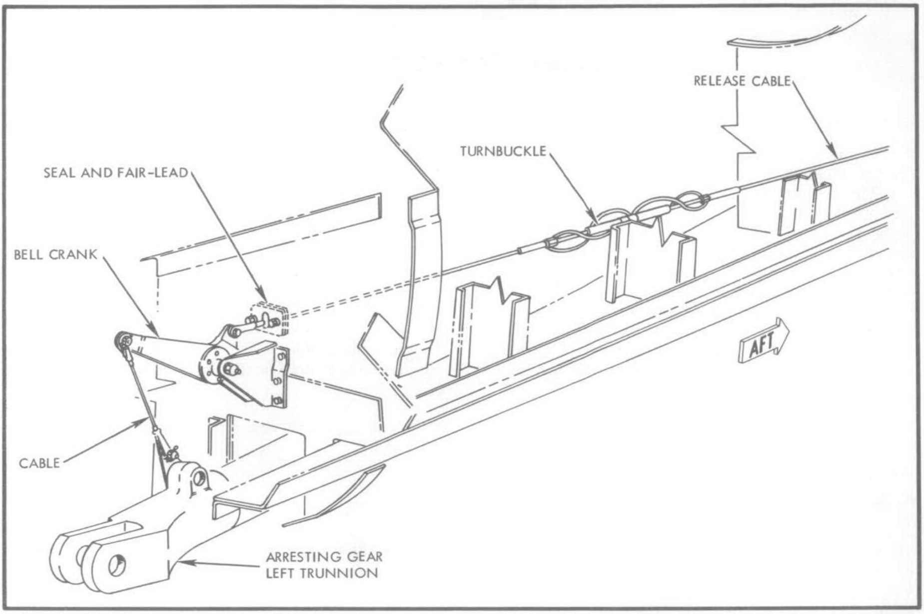
TARGET TOWING SYSTEM

7-232. TARGET TOWING SYSTEM.

7-233. Provisions incorporated in the airplane provide for the installation of a tow-target release system package. The tow-target release system package equipment is used in conjunction with the arresting gear and arresting gear control to form the complete target towing system. A bell crank attaches to the left trunnion of the arresting gear by means of a cable. A second cable, attached to the bell crank, is routed aft through the fuselage to the tow-target release mechanism assembly and is attached to the forward end of the release slide. The aft end of the release slide is attached to a fuselage structural member by means of a spring. The tow-target release mechanism is mounted on the lower side of the fuselage, forward of the tail bumper assembly. The release mechanism actuating arm extends up through a slot in the fuselage lower side and attaches to the release slide. Control of the tow-target towing and releasing system is accomplished through the arresting gear cockpit control. The towing mechanism tow ring hook is locked by pressing the tow ring firmly against the forward section of the latch. The hook will close and lock automatically. Lowering the arresting gear will actuate the tow-target release system bell crank, pulling the release cable and slide forward and releasing the tow ring from the towing mechanism hook.

7-234. TROUBLE SHOOTING TARGET TOWING SYSTEM.

PROBABLE CAUSE	ISOLATION PROCEDURE	REMEDY
TOW-TARGET RELEASE MECHANISM HOOK FAILS TO OPEN WHEN ARRESTING GEAR IS LOWERED.		
Incorrect adjustment of release mechanism cable.	Visually inspect slide and actuating arm for correct adjustment dimension.	Refer to paragraph 7-235 and adjust mechanism cable.
TOW-TARGET RELEASE MECHANISM HOOK FAILS TO RELEASE TOW RING WHEN ARRESTING GEAR IS LOWERED AND MECHANISM HOOK OPENS.		
Release mechanism hook burred or bent.	Visually inspect hook.	Repair or replace hook.
TOW-TARGET RELEASE MECHANISM HOOK FAILS TO CLOSE AND LOCK WHEN TOW RING IS PRESSED AGAINST FORWARD SECTION OF HOOK ASSEMBLY.		
Release mechanism hook actuating arm or slide burred or bent.	Visually inspect mechanism for defective components.	Repair or replace defective components.
Incorrect adjustment of release mechanism cable.	Visually inspect slide and actuating arm for correct adjustment dimension.	Refer to paragraph 7-235 and adjust mechanism cable.



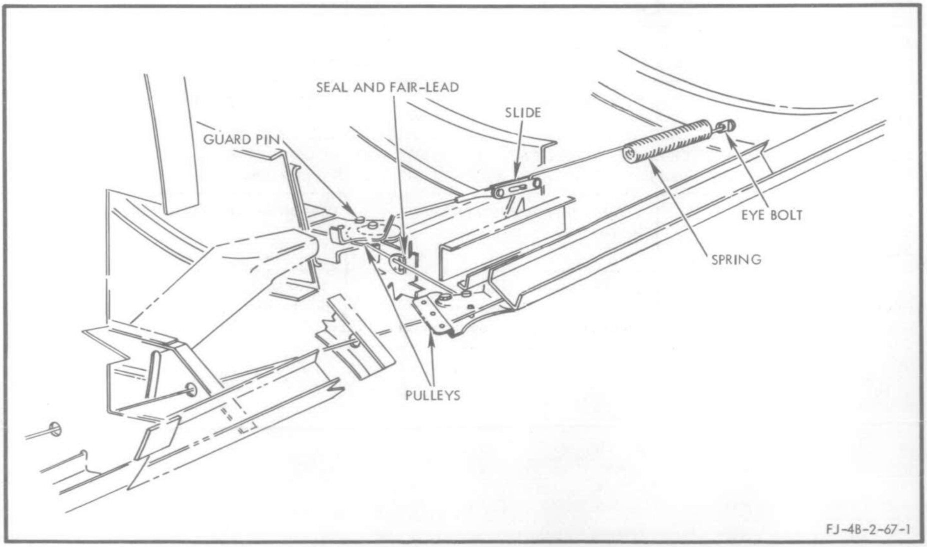


Figure No. 7-46. Target Towing Mechanism

7-235. INSTALLING, ADJUSTING AND REMOVING TARGET TOWING MECHANISM.

INSTALLING AND ADJUSTING

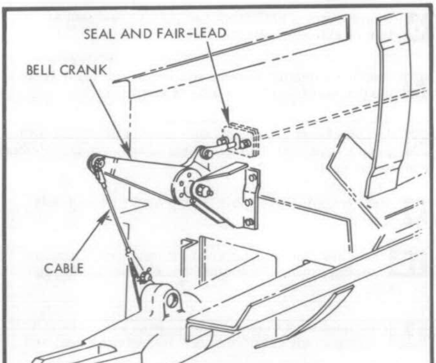
1 Remove aft fuselage section from airplane. (Refer to paragraph 2-6)

2 Remove cover plate from target release hook mounting access forward of tail bumper assembly.



3 Install bell crank in bracket provided on bulkhead aft of arresting gear hinge point.

4 Install short section of cable between arresting gear left trunnion and forward arm of bell crank. Safety attaching bolts with cotter keys.

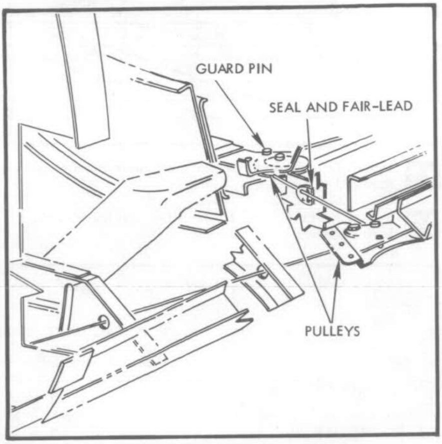


5 Feed forward section of release cable through routing hole in bulkhead and attach cable fitting to aft arm of bell crank. Safety attaching bolt with cotter key.

6 Install seal and fair-lead around cable at bulkhead just aft of bell crank.

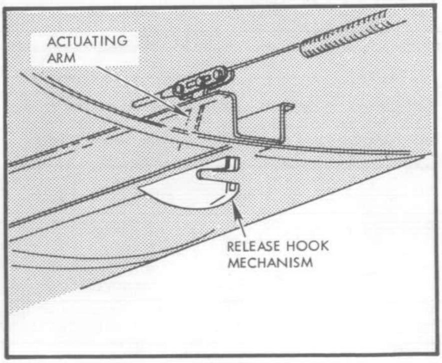
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7 Route aft section of release cable through accommodating holes in fuselage structure and through the two pulleys located forward of the release mechanism mounting point. Install guard pins in pulleys.



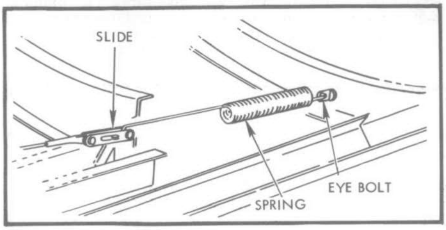
8 Install release hook mechanism on lower side of fuselage, inserting actuating arm through slot into fuselage.

9 Attach slide assembly to release arm and aft release cable fitting. Safety attaching bolts with cotter pins.



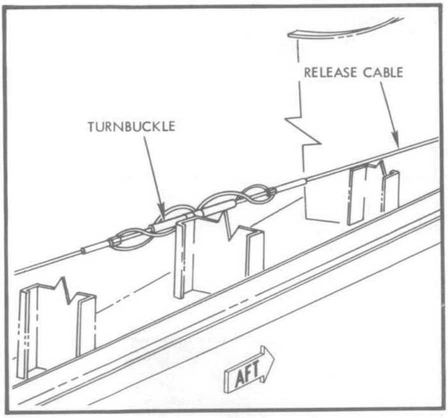
10 Install eye bolt in mounting hole in aft fuselage structural member; then install spring between eye bolt and release arm slide.

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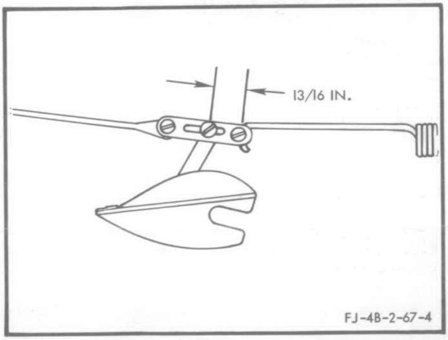


11 Install fair-lead and seal around cable at bulkhead forward of pulleys.

12 Connect forward and aft sections of release cable at turnbuckle.



13 Adjust turnbuckle to obtain dimension shown in detail below. Adjustment must be made with arresting gear retracted and release hook locked.



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14 Safety turnbuckle with AN995F41 safety wire after completing adjustment.

15 Install aft fuselage section on airplane. (Refer to paragraph 2-6.)

REMOVING

1 Remove aft fuselage section from airplane. (Refer to paragraph 2-6.)

2 Separate release cable at turnbuckle by removing center barrel of turnbuckle.

3 Remove spring from aft end of slide assembly. Remove spring attaching eye bolt from fuselage structural member.

4 Remove slide assembly from release arm and aft release cable fitting.

5 Remove mounting screws from fair-lead and seal at bulkhead forward of pulleys. Remove fair-lead and seal.

6 Remove guard pins from two pulleys and pull aft section of release cable out through pulleys.

7 Remove mounting screws and remove release hook mechanism from lower side of fuselage.

8 Remove bolts attaching cable fittings to arresting gear trunnion and forward arm of bell crank. Remove connecting cable.

9 Remove bolt from cable fitting on aft arm of bell crank.

10 Remove center mounting bolt from bell crank assembly; then remove bell crank from mounting brackets.

11 Remove mounting bolts from seal and fair-lead at bulkhead aft of bell crank. Remove the seal and fair-lead.

12 Pull forward section of release cable through bulkhead and remove from airplane.

13 Install cover plate over target release hook mounting access.

14 Install aft fuselage section on airplane. (Refer to paragraph 2-6.)

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7-236. CLEANING TARGET TOWING RELEASE MECHANISM. The target towing release mechanism should be cleaned and lubricated periodically to prevent corrosion and to ensure proper operation. Clean the mechanism with Stoddard Solvent (item 119, materials list). Dry thoroughly after cleaning and apply graphite lubricant (item 60, materials list) to all moving parts.

7-237. TARGET TOWING CABLE.

7-238. The cable used to tow aerial targets may be either 1/8 inch, 7 x 19 flexible cable, or 1/8 inch, 1 x 19 armored steel cable. These cables are of carbon steel, tin or zinc coated, preformed and highly flexible. Neither type cable is lubricated. Cables used for towing targets are subjected to severe stresses in addition to damage by gunfire; therefore, frequent inspections are advisable. Broken strands may be located by running a cloth along the cable. Since the cable is not lubricated, it should be stored in a dry place to prevent corrosion.

7-239. DRAG TAKE-OFF.

7-240. Since the tow-target system does not incorporate provisions for launching tow targets while air-borne, the banner target is towed off the ground by the airplane during take-off. The entire length of tow cable is laid out in a squat "S" pattern alongside the tow airplane's take-off run. The center leg of the "S" is parallel to the direction of take-off and the forward turn of the "S" is placed opposite the estimated take-off point. This procedure reduces abrasion of the target before becoming air-borne. The banner target is counterbalanced before take-off for either horizontal or vertical towing. Upon return of the tow airplane from a mission, the target and towing cable are jettisoned over the recovery area by lowering the arresting gear which disengages the tow ring from the release mechanism hook.

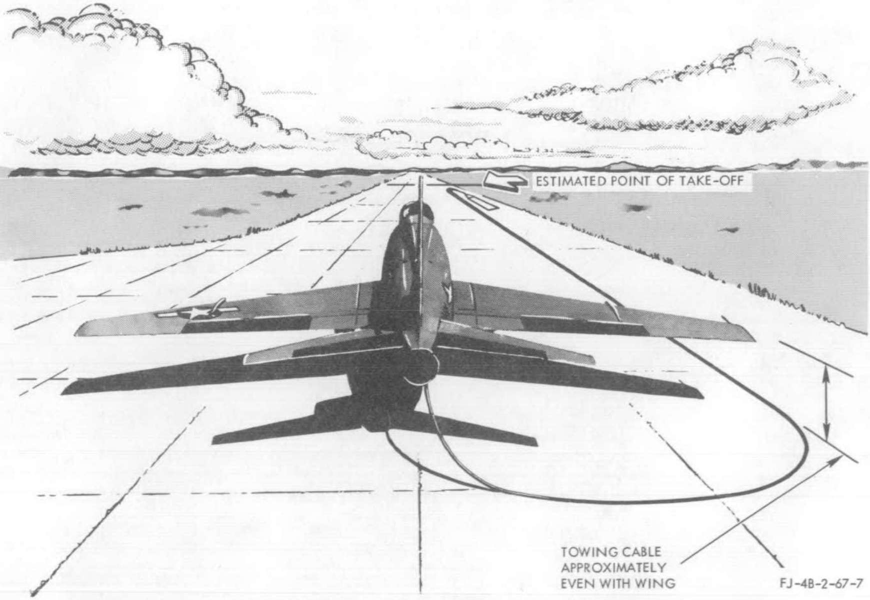


Figure No. 7-47. Drag Take-off

ALPHABETICAL INDEX

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